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The IRON AGE

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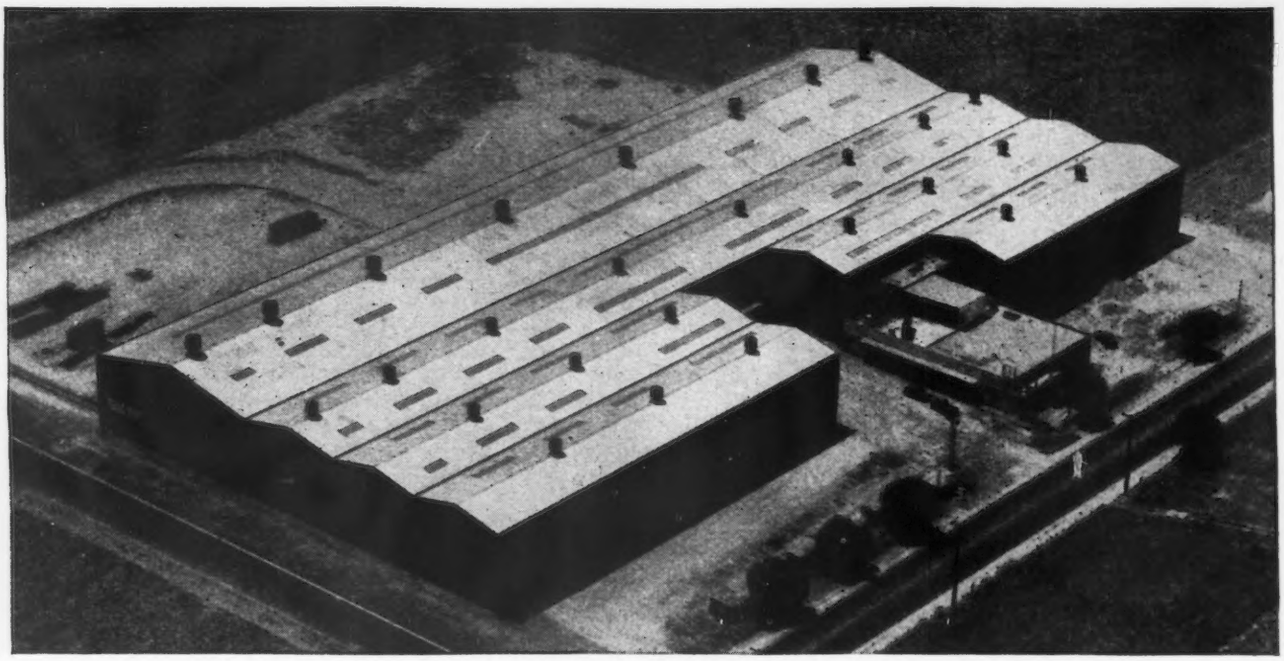

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Frightening the Frightened

THE Atomic Scientists are at it again, and their rather blurry objectives in the political arena continue to be in painful contrast to obvious proficiency in the fourth dimension.

Early in the year the papers rang with pronouncements urging unilateral sharing of atomic bomb secrets with the U.S.S.R. to salve Russian sensibilities and thereby establish a framework of mutual trust on which to erect a structure of everlasting peace. Probably this plea was motivated solely by concern for the human race, although at times it almost had an aura of reckless abandon and deliberate naiveté — certainly, monotonous failure to reach accord with Russia even on political trivia generated little enthusiasm for gratuitous generosity.

Now, the newly-formed Emergency Committee of Atomic Scientists is raising $1,000,000 to publicize that (1) atomic bombs are cheap, (2) will become more destructive, (3) military defenses are futile, (4) international control is the only alternative to a slack-jawed surviving remnant of the human race ending up by poking around in the smoking ruins of civilization. Since these facts have been so firmly pounded into the minds of the American people, there can be some question raised as to the objective of an intensified campaign.

A new flurry of blind fear could possibly create sufficient pressure for panic acceptance of something less than the Baruch proposal for international control and inspection, and that "something less" could well be only an illusion of permanent peace.

The Atomic Scientists may be falling into the pattern of World Peaceways, that curious pre-war organization that spearheaded numerous dramatic advertisements depicting the horrors of war and the futility of warfare—even for self-protection. While the motive may have been commendable, it is possible that the advertisements may have actually contributed to the confidence of aggressor nations. World Peaceways efforts could well have been more effective if they had appeared in Germany.

Perhaps the Atomic Scientists should use their $1,000,000 to get the horror of atomic warfare before the Russian people. Or, perhaps they could encourage their technical compatriots in Russia to break a curious silence and tell the story of possible doom. The story should interest the Russians as only a few inches of type have appeared on the bomb since Hiroshima.

The American military, both publicly and privately, are in favor of international atomic control; even the American politician is willing to pour a great deal of American sovereignty into the common pool; there has for a long time been a firm, detailed American plan for atomic control struggling for a place on the UN agenda.

The American people are already frightened enough.

Marshal Stalin is the one who publicly derides the bomb and says it frightens only the timid.

T. W. Lippert

Inland Buys War Plant

•

—*Will Aid Housing Program*

Another move in the Inland expansion program has just been completed with the purchase of a large government-owned blast furnace and coke plant adjoining Inland's Indiana Harbor plant.

This plant, including two blast furnaces, two batteries of coke ovens, a by-product plant and other auxiliary buildings and equipment, was built and operated by Inland for the government during the war. The reopening by Inland marks its first operation for pig iron production since shortly after VJ day.

At present, this production has been pledged to NHA to help relieve one of the nation's biggest domestic problems . . . veterans' housing. However, when the veterans are served, it will be available to pig iron consumers generally.

This acquisition will not mean more steel today because there will be no immediate increase in steel finishing capacity. It will, however, serve as a base for increased steel production in the future. In the meantime you can be assured that Inland is producing as much steel as possible, and the same helpful metallurgical and engineering service is always available.

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► One of the Army Air Force's newest ships, the Bell XS-1, a ship the size of a pursuit plane, is designed to fly at 1700 mph. It is powered by a 4-unit alcohol-oxygen rocket motor. Not a fighter but a flying laboratory, it has not yet been flown at supersonic speeds. Wings have an aluminum alloy skin machined out of solid stock.

► A new powder metallurgy development is a pyrite-aluminum composition with a tensile strength in the neighborhood of 12,000 psi. This comparatively high strength is secured by exposure at 600° F. Compression strength and resistance to chipping are reported good and present indications point to the possibility of using it in the general decorative or ornamental field.

► Pullman Standard Car Mfg. Co. has so adapted electronic welding control to its production line that two sides of an 85-ft passenger car can be welded in fixtures at one time with a production of over 7000 welds in slightly more than 3 hr.

► A new field of radiographic exploration is opened up by the 20 million-v betatron which can direct a single pulse (having a duration of from 0.2 to 0.4 microseconds) at a moving object. This may make it possible to examine the internal structure and condition of large parts moving at high speeds. This procedure is possible in theory but it has not been tried as yet.

► The validity of thousands of outstanding patents is now questionable as a result of a recent Supreme Court decision which invalidated a combination claim describing an invention in "conveniently functional language at the exact point of novelty." Had the inventor accurately described the machine he would have no broad rights to bar the use of his device in conjunction with other equipment, the Court held.

► A new milestone in the advance of nuclear chemistry is the isolation of americium in pure form. One of the four new elements discovered in the production of atomic energy, its isolation was revealed by Prof. Glenn T. Seaborg, of the University of California, co-discoverer of americium and plutonium.

► A special feature of a farm tractor tire built by Goodyear is a valve that permits it to be filled with water in lieu of air. The reason is that so much weight has been designed out of the newer tractors that some compensation is occasionally needed to increase traction.

► Among plans suggested for new industries in the Philippines is one for establishment of a modern steel plant. The islands are entirely dependent on this and other countries for iron and steel products.

Proponents emphasize that island mines have a current annual production capacity of from 1.5 to 2 million tons of 60-pct iron ore with known reserves of well over a billion tons.

► Shot peening, in addition to strengthening the surface zone of metal, generally increases the fatigue strength of a shot peened piece. This is borne out by tests conducted by Prof. H. F. Moore. While there has been much discussion as to whether strength increase by cold working or the setting up of residual stresses to resist applied tensile stresses is the more important factor, the increase in fatigue strength is definite.

► Messrs. W. E. Thurn and C. R. Heidbrink of Valparaiso (Ind.) University have developed a semiquantitative spot test for aluminum content in iron and steel scrap.

► All of the involved calculations needed to determine the proper size of a blanking or drawing press can now be performed on a simple slide rule invented by Len Crary, an E. W. Bliss staff engineer.

► The largest current commercial use of high temperature alloys is in the manufacture of turbosuperchargers for diesel locomotives. There are more than 30 such locomotives now on the roads.

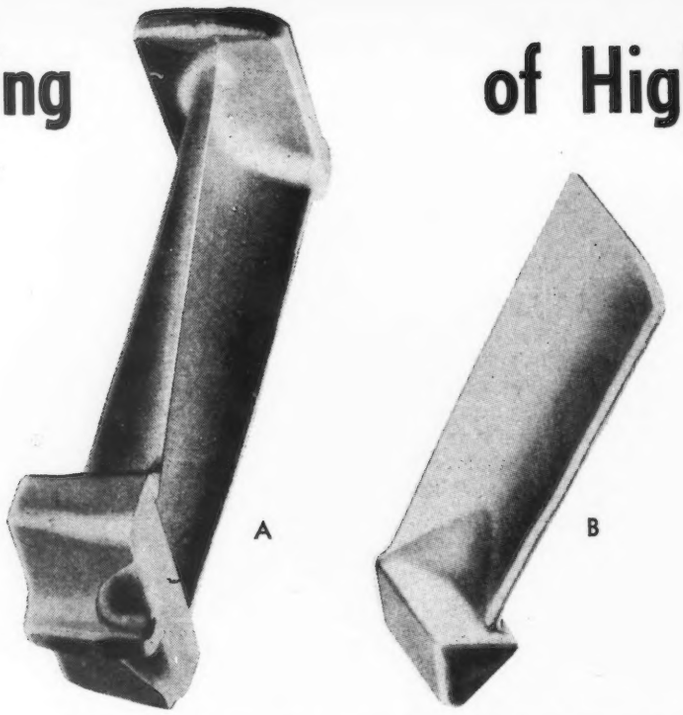
► Prices of current type motor cars are not expected to return to prewar figures in this generation. Therefore lighter cars of radically new design are almost inevitable if the motor makers are to continue volume production in "normal" times.

► During the war many an army truck driver sprained or broke a thumb when his vehicle hit a soft spot, whipping the wheel from his grip. To correct this and provide easier control many of the army's new vehicles are employing hydraulic steering devices. Others have full electric drive, electric steering and electric braking.

► Torque converters are seen as standard equipment on passenger cars of the future, eliminating gear boxes and allied equipment. They are now used on some General Motors buses; their next use will be for trucks and heavy equipment. The big problem in building converters now seems to be economical production of the baldes. Ratios as high as 6:1 are reported for one unit now under development.

Precision Forging of High Te

By C. H. SMITH, JR.
President,
Steel Improvement & Forge Co.,
Cleveland



TYPICAL gas turbine blades of various high temperature alloys. Shrouded turbine bucket of S-816 alloy, N-155 bucket. Type 347 stainless nozzle blade. Type 403 stainless compressor blade.

A GREAT deal of information has been published during the past 2 yr concerning the gas turbine and its many applications in military and civilian fields. It has been pointed out that the recent success of this type of prime mover is not due to any new or revolutionary discoveries in the field of thermodynamics, since the principle of the gas turbine is many centuries old. The development of a commercially successful gas turbine has been awaiting the discovery of materials capable of withstanding working stresses at temperatures high enough to operate the engine efficiently.

The remarkable developments in the field of heat-resisting alloys during the past several years, together with the achievements of aeronautical engineers in designing more efficient air foil sections, have made possible the construction of gas turbines with operating efficiencies high enough to warrant consideration as prime movers. Although these developments made possible the construction of efficient gas turbines on an experimental basis, they introduced problems of fabricating heat-resisting alloys to the many varied shapes necessary in quantities which would make mass production possible. Overcoming some of the difficulties advanced by the need for large quantities of gas turbine parts produced from heat-resisting stainless alloys required many new concepts of what can be fabricated by the drop forging process. It is the purpose of this paper to discuss some of the new developments in forging technique which have made possible the mass production of precision forgings from high temperature stainless alloys at Steel Improvement & Forge Co.

Very early in World War II, the Army Air Corps standardized on the turbosupercharger as designed by the General Electric Co.[1] as the method of supercharging aircraft engines operating at high altitudes.

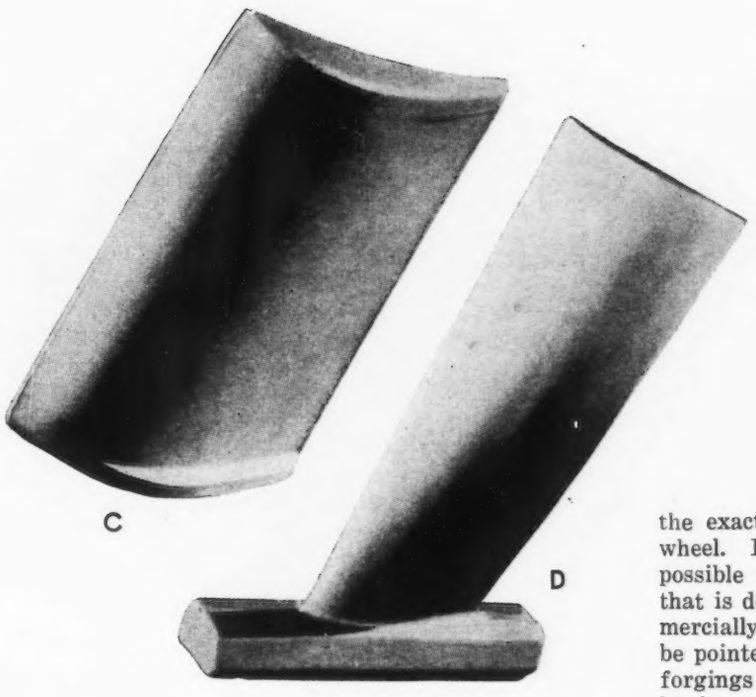
The turbosupercharger is a gas turbine using the exhaust of a conventional reciprocating engine to drive the turbine. The turbine in turn drives a centrifugal compressor, and the resulting compressed air is fed into the carburetor of the reciprocating engine. One turbosupercharger was used on each P-47 Thunderbolt; two on each P-38 Lightning; four on each B-17 Flying Fortress and B-24 Liberator, and eight on each B-29 Super-Fortress. To produce turbine wheels for such a large quantity of superchargers was one of the first problems encountered in setting up a production program. The service requirements of the turbosupercharger were such as to require speeds as high as 28,000 rpm from a turbine wheel operating at temperatures near 1200°F.

The first turbine wheels used in this application were produced as blacksmith forgings or "cheese forgings" as they were called by the engine builders. These wheels were produced by upsetting a forging billet under flat dies in an open frame hammer. Several alloys were used to produce this forging and, for the most part, these were austenitic stainless steels of the chrome-nickel, molybdenum type with alloying constituents adding up to 40 to 60 pct of the total analysis. The alloy most commonly used was the 16-25-6 alloy[2] (16 pct Cr, 25 pct Ni, 6 pct Mo) from which many thousands of satisfactory turbine wheels were produced.

Because these alloys do not respond to normal heat-treating methods for developing mechanical properties, it was necessary to work out some other method of imparting the desired physical properties. In producing the "cheese forgings," the metal was allowed to cool slightly before the last few hammer blows were struck, thereby producing a cold work or work hardening effect. It was noted that this improved the physi-

Temperature Alloys

One of the important technological achievements of World War II was the development of techniques for forging the theoretically nonforgeable high temperature alloys to the extremely fine tolerances demanded in gas turbine and turbosupercharger construction. The story of this development is told in this article by one of the foremost authorities in that field. The metallurgical and mechanical considerations involved in such precision forging, together with a detailed description of the operation sequence, are given herein.



cal properties somewhat, but it was considered unreliable due to the guesswork involved as to the temperature at which the cold work was done and the amount of cold work done. The "cheese forgings" were unsatisfactory also because of the vast amount of machining necessary. On experimental quantities this was not a big factor, but for production quantities, the expense of removing large amounts of costly, difficult to machine metal, was prohibitive.

After a great deal of development work a drop forging process was perfected which permitted the production of large quantities of die forged turbine wheels or "contour wheels" as they were called by the engine builders. By using a two step drop forging operation the introduction of a controllable amount of cold work was possible, thus insuring uniformity in the physical properties obtained in all wheels produced from dies of the same design.

The first, or blocking operation, is carried out at the normal forging temperature for the alloy being used. This is generally about 2000°F. The second, or finishing operation, is carried out between 1200° and 1350°F. Both operations are performed in large steam drop hammers ranging in size from 8000 to 35,000 lb, the exact size varying with the size of the turbine wheel. By properly designing the blocking die, it is possible to control exactly the amount of cold work that is done in the finishing die and to assure a commercially uniform cross-section hardness. It should be pointed out that improper die design will result in forgings lacking the required physical properties and having a variable cross-section hardness.

Between the blocking and finishing operations the forging is allowed to cool to room temperature so that a close visual inspection can be made and any imperfections removed. After the finish forging operation the turbine wheels are annealed for about 6 hr at 1200°F to relieve any strains induced by the cold working operation. Fig. I indicates the cross-section hardness of a typical turbine wheel made in this manner from 16-25-6 alloy. Table I shows the room temperature physical properties which were obtained from the same turbine wheel. The fine lines in fig. 1 indicate the position of test coupons shown in table I. By varying either the finish forging temperature or the amount of cold work, or both, the hardness may be raised or lowered to produce the desired physical properties.

The gas turbine used to power a jet propulsion or prop-jet plane resembles the turbosupercharger in many ways. The turbine wheels are produced in the same manner as those for superchargers, although larger hammers are required because of the increase in size of the wheel.

It should be pointed out that generally speaking the most satisfactory turbine wheel is produced when maximum work has been performed on the material involved. This means that the alloy should be poured in the largest ingot size possible and then should be rolled or cogged to the smallest possible bar or billet size necessary to produce the desired forging. It can be readily seen that as the size of the turbine wheel increases, the billet size necessary to produce the wheel also increases, thus decreasing the amount of reduction from the ingot to the billet. This has on occasion led to difficulties on the large size turbine wheels

[1] *The high temperature metals used in this unit were described in "Metallurgical Development of Materials for Turbosuperchargers and Aircraft Gas Turbines,"* THE IRON AGE, *July 25 and Aug. 1, 1946.*

[2] *See "16-25-6 Alloy for Gas Turbines,"* THE IRON AGE, *Jan. 17 and 24, 1946.*

TABLE I

Physical Properties of 16-25-6 Alloy Turbine Wheel (Properties of wheel shown in Fig. 1—at room temperature)

Position of Test Coupon[1]	Yield Strength, 0.2 pct	Tensile Strength, psi	Pct Elongation, 2 in.	Pct Reduction In Area
1.....	79,500	122,000	6.0	8.5
2.....	84,500	126,000	20.5	28.5
3 (Tangential)..	83,000	125,500	22.0	32.0

[1] See fig. 1 for location of test coupons.

found in the bigger jet propulsion engines.

In an attempt to overcome the difficulties inherent in the very large turbine wheels, a great deal of work has been done on producing a composite wheel made from two forgings. The rim of the wheel, which is subject to the highest working temperatures, is forged from a heat-resisting alloy such as 16-25-6, or 19-9 DL (see Table II for composition), or N-155, and the center part of the wheel from aircraft quality SAE 4340. This composite wheel makes it possible to produce the heat-resisting stainless alloy forging from a much smaller billet than would be required for producing a solid turbine wheel entirely from the heat-resisting alloy. It also naturally makes a saving in the amount of high priced heat-resistant alloy necessary. These wheel rim forgings are produced on large open frame hammers with a two step operation similar to that used in producing solid wheel forgings. After the rim and the center forgings have been rough machined, they are welded together by arcwelding.

One of the most important differences between the turbosupercharger and the jet engine gas turbine is the service required from the turbine blade or bucket. Although the rotational speed of the jet gas turbine is considerably less than the turbosupercharger, it is required to operate at higher temperatures. The larger size of the jet engine turbine wheel must also be taken into consideration as the increase in the radius increases the tip speed. The increase in size of the turbine bucket increases the weight, and consequently the stresses on the bucket due to centrifugal force are greater than those found on the turbosupercharger. The combination of these factors made it apparent that the turbine blades for jet engine use would have to be far stronger than the cast blades used on turbosuperchargers. Some of the companies manufacturing gas turbines had produced forged turbine blades in their own forge shops for a number of years for use in steam turbine applications. However, it had not been possible to interest commercial drop forging companies in producing these items because of the large number of problems involved. The forging of gas turbine blades created even more difficult problems than those encountered on steam turbine blade work.

These difficulties can be briefly summarized as follows: First, the alloys used for gas turbine blade applications have generally been considered nonforgeable. The basic principle of all forging operations is to heat metal to a temperature at which it is plastic and then to form it to the desired shape. The alloys used for gas turbine blading are heat resistant or, in other words, are designed to resist deformation at elevated temperatures. These two basic fundamentals are in direct opposition to each other, thereby creating difficult forging conditions.

Second, the geometric shape of a gas turbine blade is difficult to obtain by forging operations. This shape almost invariably is a combination of most of the undesirable conditions that can possibly be found in a forging design. The blade section is extremely thin with almost a knife edge. Attached to the very thin section of the blade is a comparatively heavy section which forms the root or base of the turbine blade. A thin section adjacent to a heavy section in any forging design leads to difficulties in the heating and forging operations, as well as to problems of warpage and cracking while cooling. The corner joining the root and blade generally has a very small radius or fillet which increases the difficulties involved. Frequently the blade is designed with a sharp warp along its length.

The third basic problem is that the tolerances necessary for this type of work are extremely close because the heat-resisting alloys used are not commercially machinable. The only practical method of removing metal from the turbine blade once it has been forged is by grinding. In most cases it has not been possible to set up grinding operations because of the complicated shapes involved and because grinding marks in certain directions could set up stress concentrations which would be dangerous considering the operating conditions involved. Any attempt to hand grind generally results in a contour more remote from the true contour than the original forged shape. For these reasons gas turbine blades must be forged to the desired finished shape and held to the tolerances necessary in the finished blade.

The accuracy required in balancing a turbine wheel revolving at 12,000 rpm and the aerodynamic problems involved in passing hot gases through nozzles and against turbine blading moving at almost supersonic speeds, suggest the reason for the close tolerances necessary on this work. Normal tolerances used on turbine blade forgings are approximately +0.010 in., −0.000, although the variation from the true contour of the blade is held to +0.005 in., −0.000. Fig. 2 is an extremely simplified forging drawing for a typical shrouded turbine bucket. A complete drawing would contain anywhere from 3 to 15 blade cross-sections together with plan views.

These three major problems in forging gas turbine

TABLE II

Composition of High Temperature Alloys Commonly Used for Forged Turbine Blades

Material	Carbon	Nickel	Chromium	Molybdenum	Tungsten	Cobalt	Others
S-816.....	0.30–0.45	18.0–22.0	18.0–22.0	3.0–5.0	3.5–6.0	38.0 min	Cb 2.5–4.0
N-155.....	0.10–0.20	18.0–22.0	18.0–22.0	2.5–3.5	2.0–3.0	18.0–22.0	Cb 0.75–1.25 N_2 0.10–0.20
Hastelloy B.....	0.02–0.12	62.5–68.5	.....	26.0–30.0	.....	.....	Va 0.25–0.50
Inconel X.....	0.08 max	71.0–75.0	14.0–16.0	Ti plus Al plus	Cb=4.0 pct	.....	
19-9DL.....	0.26–0.36	8.0–10.0	18.0–22.0	1.0–1.5	1.0–1.5	.....	Cb 0.20–0.60 Ti 0.20–0.60

blades resulted in several corollary problems. When it is necessary to hold close tolerances on a forging, the die life is always shortened, for it is not possible to allow the die to wear a normal amount. Die wear is always accelerated on a thin forging because there is not enough hot metal between the top and bottom dies to cushion the blow and protect the die. Another factor leading to a shorter die life is the difficulty in forging the heat-resisting alloys that are used. It requires a much harder blow to flow these alloys than it does the normal forging materials and, consequently, there is a far greater reduction die life.

It was necessary to design and build special forging furnaces with controlled atmosphere for two reasons:

(1) Scaling of the blade surfaces has to be kept at a minimum in order to avoid the necessity of a finishing operation on the blade, and (2) some of the alloys used for turbine blades are subject to intergranular oxidation necessitating a slightly reducing atmosphere. Other alloys must be forged in a slightly oxidizing atmosphere to prevent carburization.

Naturally the drop hammer and trimming presses on which the actual forging operations are carried out have to be in excellent condition and in perfect alignment. Any sloppiness in this equipment would be transmitted to the forging and cause rejection because of the extreme accuracy required. Board hammers are used because they afford greater control than other methods of production. Special blast cleaning equipment was installed to give the extra smooth surface required.

Forged blades for gas turbines are used in any or all of three applications. The most difficult blades to produce are those used as turbine blades because of being subject to high temperatures and rotating at high speed. The materials used for this application are stainless alloys of nickel, chromium, cobalt, molybdenum, tungsten and columbium. These alloys rarely have more than 5 pct iron content. Alloys commonly used include Hastelloy B, S-816, N-155, 19-9 DL and Inconel X. Table II gives the composition of these alloys.

The second category of forged blades are the nozzle blades used to direct the hot gases from the combustion chambers to the turbine blades in a manner that will permit the maximum conversion of heat energy to mechanical energy. Although these nozzle type blades must operate at high temperatures (up to 1500°F), they are stationary and hence are not subject to the high stresses found in turbine blades. Stainless steels of the 18-8 type are generally used for this application.

The third type of forged blades used in the gas turbine field is found in turbines using axial flow compressors. On many of the axial flow compressors now being used forged blades are used for both the rotor and the stator blades and the total number of blades on each compressor totals almost 2000 blades. Stainless steel of the 12 pct Cr type is generally used for this application, although aluminum blades are sometimes used for the first few stages.

The actual manufacturing cycle involved in producing turbine blades varies with the type of forging being produced. However, a typical cycle would include the following steps. After the incoming bar stock has passed laboratory inspection, it is cut into forging multiples. This is usually done with abrasive cutoff wheels. The multiples are brought up to forging temperature in atmosphere and pyrometer controlled furnaces. Fullering or upsetting operations are performed to get the correct amounts of material in the right locations. It is sometimes necessary to reheat the stock several times before this operation is complete. The forging blank is then allowed to cool to room temperature and is shot blasted to remove scale so as to permit close inspection for any signs of seams, cracks or folds, or other defects. Any imperfections are ground out and the blanks are returned to the forge shop for further work.

The next forging operation is to flatten the blank and approach the finished shape by striking one or two blows in the blocking die. The flash is removed in a trimming press and the forging is reheated. This cycle of heating, forging and trimming is repeated until the blade is down to size in the blocking die. Once again it is allowed to cool to room temperature and it is inspected for imperfections. The blades are then returned to the forge shop where the cycle of heating, forging and trimming is commenced all over again; this time in the finishing die. This cycle is

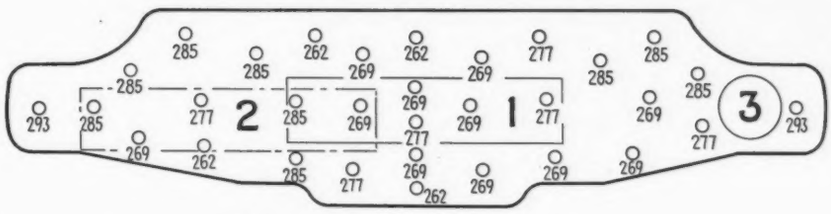


FIG. 1—Cross-section hardness of a typical forged turbine wheel of 16-25-6 alloy. Physical properties of this wheel are shown in table I.

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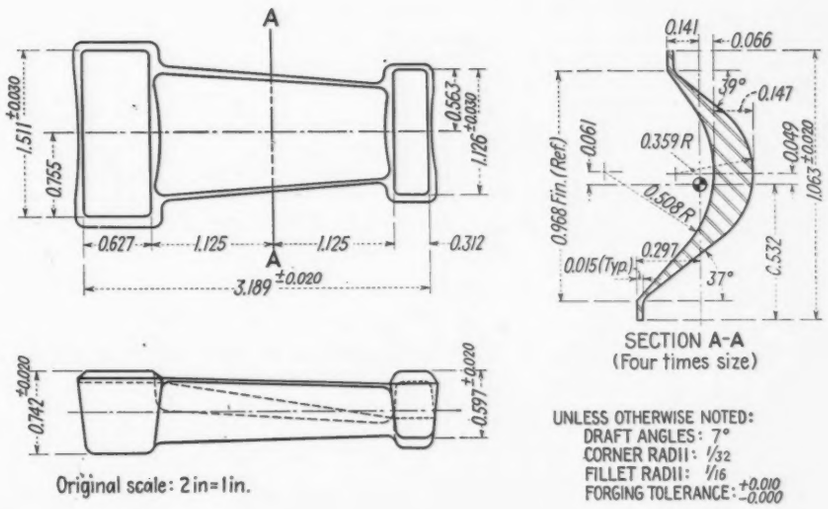
FIG. 2—Simplified forging drawing of a typical shrouded turbine bucket.



repeated until the blade is down to size, as indicated by suitable precision gages. Blades are sent to the finish inspection department at regular intervals to check physical dimensions on a comparator. If any heat treatment is required, it follows the operations in the forge shop, after which 100 pct Rockwell hardness checks are made. The blades are then blasted with a very fine shot and given a Magnaflux or Zyglo inspection, depending upon whether the alloy is magnetic or nonmagnetic. All blades passing this inspection are sent to the finish inspection department where dimensions and surface conditions are checked 100 pct. Throughout the manufacturing cycle the blades are handled in lots not to exceed 200 and each blade is identified with a lot number before shipping.

The events of the past 3 yr indicate definitely that drop forged blading can be successfully produced in large quantities to very close tolerances. The chief requisites for doing this type of work are modern die sinking and forging equipment kept in excellent condition, a good engineering staff capable of designing the very complicated die equipment, a metallurgical staff with the ability to properly control the flow of materials through the forging and heat-treating stage and, most important of all, a great deal of patience and tenacity. Equipped with these assets, forge shops are going ahead with development programs which will in due time permit the mass production of precision forgings to even closer tolerances at lower costs.

Material Strength Data for Tool and Die Designers

INFORMATION as to the average ultimate shear and tensile strength of a number of materials is frequently required by designers and tool engineers, particularly those engaged in die design and press calculations. In most cases this involves a search through a number of handbooks, many of which are liable to be out of date, or the use of catalogs and manuals furnished by material suppliers. Faced with this difficulty, engineers of the E. W. Bliss Co., Detroit, prepared the accompanying table from actual physical experiments in the company's own laboratory, and as far is is known, this is the only table of its type in existence.

Average Ultimate Strength of Materials

Material	Shear psi	Tensile psi
Aluminum, sand cast, silicon 5 pct	14,000	19,000
Die cast, silicon 5 pct	22,000	29,000
2S-O	9,600	13,000
2S-¼H	10,000	15,000
2S-½H	11,000	17,000
2S-¾H	12,000	20,000
2S-H	13,000	24,000
3S-O	11,000	16,000
3S-¼H	12,000	18,000
3S-½H	14,000	21,000
3S-¾H	15,000	25,000
S3-H	16,000	29,000
Alclad 14S-O	18,000	25,000
Alclad 14S-W	40,000	64,000
Alclad 14S-T	42,000	69,000
17S-O	18,000	26,000
17S-T	36,000	62,000
24S-O	18,000	27,000
24S-T	41,000	68,000
24S-RT	42,000	73,000
Alclad 24S-T	40,000	64,000
Alclad 24S-RT	41,000	67,000
52S-O	18,000	29,000
52S-¼H	20,000	34,000
52S-½H	21,000	37,000
52S-¾H	23,000	39,000
52S-H	24,000	41,000
61S-O	12,500	18,000
61S-W	24,000	35,000
61S-T	30,000	45,000
75S-O	.....	40,000
75S-T	47,000	88,000
Alclad 75S-O	.....	32,000
Alclad 75S-T	46,000	76,000
Asbestos, sheet	4,000	.....
Brass, cast, leaded red, Cu 85 pct, Sn 5 pct, Pb 5 pct, Zn 5 pct	36,000	46,000
Die cast	45,000	55,000
Cartridge, Cu 70 pct, Zn 30 pct, soft	32,000	47,000
Forging, Cu 60 pct, Zn 38 pct, Pb 2 pct soft	48,000	60,000
Rolled strip and sheet, Cu 65 pct, Zn 35 pct, soft	32,000	46,000
¼ hard	40,000	59,000
½ hard	44,000	65,000
¾ hard	47,000	72,000
Hard	50,000	78,000
Extra hard	54,000	84,000
Spring	57,000	95,000
Britannia metal	9,000	8,000
Bronze, phosphor, grade A, sheet, annealed	40,000	55,000
Spring temper	65,000	105,000
Cardboard, hollow cutter, chipboard	6,000	.....
Juteboard	11,000	.....
Pressboard	21,000	.....
Copper, soft	24,000	32,000
Hard	37,000	55,000
Cupronickel, Cu 80 pct, Ni 20 pct, soft	35,000	48,000
Duralumin, annealed	20,000	28,000
Fibre, hard	24,000	.....
Vulcanized	13,000	15,000
Gold, 14 carat, soft	42,000	58,000
Gilding metal, Cu 95 pct, Zn 5 pct, soft	25,000	35,000
Iron, cast	25,000	22,000
Cast, malleable	48,000	54,000
Lead	3,500	5,000
Leather, oak, male and female	6,500	3,500
Monel metal, soft	50,000	70,000
Nickel	53,000	68,000
Nickel (German) silver, Ni 18 pct, Cu 65 pct, Zn 17 pct, soft	35,000	58,000
Paper, hollow cutter	12,000	.....
Silver, sterling, soft	27,000	37,000
½ hard	45,000	65,000
Steel, mild	50,000	60,000
Armco Iron, annealed	40,000	45,000
Boiler plate	55,000	70,000
Casting	60,000	70,000
Hacksaw blade	78,000	105,000
Nickel, 3½ pct	70,000	85,000
Silicon	60,000	72,000
Stainless, 18-8	75,000	95,000
Cutlery, knife 410, full hard	145,000	.....
Cutlery, fork and spoon, 420 ¼ hard	65,000	.....
Wrought iron	40,000	48,000
Structural	45,000	60,000
Rolled strip and sheet, soft, extra deep drawing	41,000	48,000
Soft, deep drawing	42,000	53,000
¼ hard	45,000	60,000
½ hard	50,000	72,000
Hard	61,000	92,000
SAE, 1010, cold-rolled	42,000	56,000
1015, cold-rolled	50,000	67,000
1020, cold-rolled	52,000	69,000
1025, cold-rolled	60,000	80,000
1030, cold-rolled	63,000	85,000
1040, cold-rolled	73,000	100,000
1050, cold-rolled	82,000	110,000
1075, hot-rolled	78,000	103,000
1095, hot-rolled	80,000	106,000
Tin, block	4,000	5,000
Wood, plywood, hollow cutter	5,000	.....
Zinc, commercial	19,000	23,000
Drawing	16,000	20,000

Oxygen In Steelmaking

Use of oxygen in steelmaking, a concept not entirely new to American steelmakers but long delayed in adoption by cost factors, has recently been given considerable impetus by developments which promise to make available large quantities of oxygen at substantially lower cost than has been heretofore possible. In this article the author discusses some of the factors leading to the development of low cost oxygen and describes experimental open hearth heats using oxygen which suggest the possibility of considerable reduction in processing time. While it is yet too early to appraise fully the implications of this new technique, experience to date indicates that it is possible that widespread use of oxygen will have important technological and economic effects upon the steel industry.

By E. S. KOPECKI
Associate Editor

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ALTHOUGH engineers have for many years toyed with the idea of enriching the oxygen content of air used for combustion of fuel in steelmaking in order to minimize the Btu's wasted in heating the large volume of inert nitrogen present in air, it is primarily during the past year that the subject has aroused considerable interest among practical steelmakers. This is due partly to the efforts of oxygen manufacturers to furnish lower cost oxygen in the purity desired, and in the large quantities required. Moreover, experimental work of a practical nature conducted by enterprising manufacturing plants—for example, The Steel Co. of Canada, Ltd., Hamilton, Canada—has given promising results for the future.

However, progress reported made by both oxygen producers and consumers has been so sketchy and so diversified in opinion, especially when compared with similar work conducted in Europe, that clarification of the relationship of oxygen to industry is in order. It is attempted herein to present a proper perspective of the situation by correlation of published and unpublished data and comments expressed by individuals prominent in their respective fields. It is to be understood that this brief summary is far from presenting a complete picture. Because of the highly competitive nature of this promising subject, both among oxygen producers and the steelmaking industry, and because of the fact that many of the experiments being currently conducted are so inconclusive, only an introduction to the subject is possible at this time.

Oxygen Production Problems

High-purity oxygen (99.5 pct) has been used on a commercial scale for some years by the metalworking industry for cutting, scarfing and welding. Because of the conditions governing its manufacture, however, such high-purity oxygen cannot be produced in the large quantities necessary for the openhearth or blast furnace, and cannot be produced for anywhere near a reasonable cost to warrant its use for these purposes. To produce 99.5 pct oxygen (all existing processes follow a similar pattern) air must be compressed to 250 to 300 psi by means of massive reciprocating compressors, cooled by intricate heat exchangers, expanded in a smaller reciprocating expansion engine, liquefied and finally passed through a slow rectification process in a distillation column. This means high capital investment, high power costs and definite limitations in production volumes per size of unit.

Slight modifications are possible to this existing process in order to produce oxygen with lower purity, much more cheaply than the 99.5 pct product. Regenerators, more efficient and simpler to construct, can be used in place of the heat-exchangers, for cooling the incoming air and removing moisture and carbon dioxide from the air, at a very small pressure drop. In view of the higher efficiency and lower pressure drop of the regenerators, massive reciprocating compressors can be replaced by turbocompressors which deliver air at about 6 atmospheres. Then, in order to expand the tremendous quantity of treated air at low pressures, high-speed turbines are resorted to, replacing the reciprocative-type expansion engines. Though cheaper than 99.5 pct oxygen, the 95 to 98 pct product cannot be produced cheaply in small enough quantities to interest current users of oxygen for cutting, etc. Further, once a low cost oxygen unit has started to produce, it always operates at its rated capacity, and offers no flexibility for variations in load. Furthermore, oxygen can only be delivered in gaseous form and at a low pressure not exceeding 12 psi.

An important consideration confronting engineers is to discover the optimum oxygen purity for the purpose intended. Production data shows that the cost of power constitutes a substantial portion of the production of oxygen, and the cost of power per unit volume oxygen produced varies considerably with purity of product. For example, data has been presented to show that while 0.28 kw-hr per cu meter of pure oxygen in the mixture is required to produce oxygen of 45 pct purity, 0.50 kw-hr is required to produce 98 pct oxygen.

High-capacity oxygen plants of the Frankl type have been built in Germany and France, capable of producing about 115 tons per day of oxygen 90 to 98 pct purity. A plant constructed in 1936 near Paris, by L'Air Liquide Co. of France, treats 33,000 cu m (1,165,230 cu ft) of air per hour, while the USSR possesses several units with a production of 3500 cu m (123,585 cu ft) oxygen per hour. At the present time, two new Frankl units are being built in Europe for producing 90 to 98 pct oxygen for chemical purposes.

At the present time, there are no large oxygen-producing plants in North America for producing the lower purity product. However, a Frankl unit is being built in Johnstown, Pa., under the direction of the Air Reduction Co., while the Canadian Liquid Air Co. is arranging for the construction of a large plant in Hamilton, Ontario. Based on experience gained from development work carried on at Olean, N. Y., two plants, each to produce 48 million cu ft oxygen per day, have been designed. The first unit now un-

der construction at Brownsville, Texas, is to operate in connection with the Hydrocol Process engineered by Hydrocarbon Research, Inc., for the processing of natural gas to produce motor fuel, diesel oil and crude alcohols. The second unit is for Stanolind Oil and Gas Co., also to supply oxygen for a Hydrocol plant. The Linde Air Products Co. ships oxygen to its customers in tank cars and trucks, in liquid form. A conversion unit, attached to the consumer's storage tank, converts the liquid oxygen into gaseous form. In this manner, relatively large amounts can be supplied consumers, since 1 cu ft liquid oxygen is equivalent to about 862 cu ft of gas at atmospheric conditions, and a tank car of liquid oxygen, 60,000 lb, converts to about 750,000 cu ft of gaseous oxygen.

Although some work had been done years ago with the use of oxygen, in this country (H. C. Bigge of Bethlehem Steel Co. experimented with the use of oxygen for carbon reduction in the electric furnace some 20 yr ago), the greatest strides seem to have first been made in Germany. Lennings[1] reported tests conducted on a blast furnace producing 50 to 60 metric tons pig iron per day, supplying oxygen from an oxygen plant with a capacity of 4400 cu m (155,364 cu ft) per hr. It was found that, under certain conditions, the productive capacity of the furnace could be increased by about 20 pct when using oxygen-enriched air (24 to 30 pct). Lennings also discussed tests made to determine optimum conditions for smelting lean German ores with oxygen-enriched blast, using a furnace 46 ft high with a hearth 7 ft 9 in. diam. In two cases (1) with a burden of 100 pct lean German ores and (2) with a mixture of rich and lean ores so that each supplied 50 pct of the iron content, the use of oxygen-enriched blast greatly increased output and, provided certain conditions were adhered to, resulted in a marked decrease in coke consumption.

Shapovalov[2] states that since enriched air increases the temperature of combustion, the mean temperature in the blast furnace hearth can be increased, and the blast furnace can be utilized to produce ferrochromium, silico-chromium and high percent ferrosilicon. These are promising applications for the oxygen-enriched blast, but the data presented in the paper are somewhat speculative. The fuel requirements and tonnages for various degrees of enrichment will have to be determined experimentally or projected after more actual data on the use of oxygen are obtained. An interesting concept is to inject steam into a blast furnace operating on enriched air to produce top gas rich in hydrogen and carbon monoxide and relatively low in nitrogen. Such a gas may have uses in the chemical field (to produce ammonia); however, the primary consideration in applying oxygen enriched air to the blast furnace seems to lie more in the prospects for additional tonnages of pig iron at reduced coke rates.

Durrer, Lwowycz and Marincek[3] experimented with a low-shaft furnace to determine the effects of oxygen content and velocity of blast, and the effect of height of bed, on the combustion of coke. An interesting observation made by the authors is that the zones of combustion marked by the disappearance of carbon dioxide get smaller as the oxygen content of the blast increases. The greatest change was found to occur between 21 and 42 pct oxygen. It is questionable as to the effect on furnace practice of a substantial reduction in the size of the combustion zones and a narrowing of the active periphery. A point may be reached at which further enrichment yields little beneficial effects because of the fact that the higher temperature zone is narrower in cross section. The periphery of large furnaces is normally much more active than the central area in the hearth. The question arises as to what will be the effect if the temperature is raised in a still narrower peripheral zone.

The later work of the Russians was recently touched on by Langmuir,[4] wherein he reported the excellent results being obtained, in boosting blast furnace output by five to six times the output when using oxygen-enriched air. Other investigators report, however, that although it is true that output is increased, the experiments are conducted on a pilot blast furnace, with hearth diameter of about 40 in., using bottled oxygen, and hence do not represent practical operation. These investigators claim that the results obtained are about the equivalent of early German experiments of 15 or 20 yr ago. Although Langmuir states that temperatures are not materially increased (not as much as 100° higher) and that there is no serious difficulty with the refractory materials used, others claim that the furnace lining fails in very short order.

Attention in the United States is directed to the Johnstown plant of Bethlehem Steel Co., where Air Reduction is preparing to pipe oxygen from a commercial plant for actual blast furnace practice experiments. It has been said that the tests are to be initiated with oxygen enrichment of about 26 pct.

It is not anticipated that the use of oxygen in the blast furnace will assume other than experimental proportions for some time to come. This is readily evident when one considers the difficulty in experimenting with an installation the size of a blast furnace and the tremendous amounts of oxygen that would be required. It is said that no manufacturer has sufficient production capacity at this time to produce the oxygen required to run a blast furnace heat. Moreover, since the production of pig iron is a continuous process, it would be impossible to conduct intermittent tests, as is done in the case of the openhearth.

Another interesting application is the use of oxygen in the bessemer converter. Experimental work was done in Germany, at Oberhausen, using a 45 pct enriched-air blast. This use was interesting in view of the high sulfur content of German ores, and it is reported that this method is once again receiving widespread use in postwar Germany. A small amount of work has also been done in England on enriched air for the bessemer, but it appears that refractory difficulties discouraged the investigators. German technicians are reported to have also experimented with enriched blast in the cupola, but results of this work are not known.

Openhearth Practice

The most comprehensive experiments attempted with the use of oxygen in the openhearth have been conducted by the Steel Co. of Canada in cooperation with Canadian Liquid Air Co., Ltd. A rather unique program was arranged so that experiments could be performed with production equipment. A pipeline connects the two Hamilton plants whereby high purity oxygen is supplied to the steel company for use in cutting, welding, etc. Experiments with oxygen in the openhearth were conducted on week-ends, at which times oxygen consumption was lowest, and the large amounts of oxygen needed, could be furnished. About 50 tons oxygen, 1,200,000 cu ft, are required to keep an openhearth furnace going for 24 hr.

The object to using oxygen in melting scrap in the

openhearth furnace is to burn fuel as rapidly as possible, and thus create a large amount of heat. Ideally, this heat will be absorbed by the melting scrap so fast that the temperature is not excessive—high temperature is of importance only if temperature gradient is the limiting factor in the heat flow. If the temperature is higher than necessary it becomes a disadvantage. The blow torch effect is designed for rapid melting of scrap. In order to speed up the rate of combustion, it is necessary to bring the fuel (whether oil, pitch, gas or powdered coke) into intimate contact with oxygen. In fuel combustion, two reactions occur. Fuel combines with oxygen to form readily combustible secondary products, which then combine with additional oxygen to end up as water and carbon dioxide. By conditioning the fuel with oxygen, the first and second reactions can be brought to completion so rapidly that the Btu heat value produced is concentrated over the area being heated. It is said that when using air, much of the developed heat is carried away and lost due to the slowness with which the fuel mixed in with the oxygen of the surrounding air, thereby preventing the second reaction taking place as quickly as possible over the area to be heated. Color slides taken of the openhearth combustion flame show very distinctly the difference in flame characteristics, when using air and when using oxygen. An observer of this phenomena stated that the flame showed an intense white streak where the steam-oil

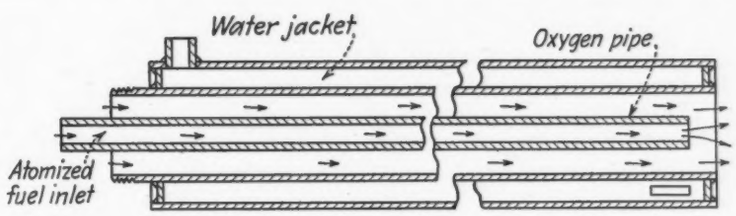

FIG. 1—Schematic sketch of burner for atomized fuels and oxygen.

mixture raced outward from the burner pipe parallel to the oxygen stream. This "silver streak" seemed to pre-ignite the oil so that a brightness was developed in the flame almost as soon as the oil emerged from the burner pipe. No prolonged black core existed in the flame as is common during regular scrap melting operations. The flame was intense but short.

The first test at the Steel Co. of Canada was made early in 1942, using oxygen adjacent to the oil stream, whereby a ¼ in. diam copper tube was inserted along with the regular burner, so that two streams emerged alongside one another. This arrangement was used only on one end of the furnace, but even the relatively small amount of oxygen that could be introduced in this manner was sufficient to lessen the time required to melt scrap at the end of the furnace in which it was installed, as compared to the opposite end. No further experimental work was undertaken until 1946, at which time a burner, as described by Bailey (fig. 1), that had been adopted for combination burning of gas and oil was used. The oxygen was admitted into the regular gas passage and formed an annular ring around the oil burner pipe. This was done to facilitate in a physical way the uniform and speedy mixture of oxygen and oil.

Even with the use of oxygen, the amount of extra fuel that can be economically burned by a furnace is not the maximum fuel it can burn. In the tests reported above increases in fuel input from 35 to 62 pct above normal were tried, with the optimum amount being about 40 pct.

After several successful experiments with oxygen, qualitatively, it was desired that a standard for judging the improved performance be established. A normal heat was run, with the operators instructed to do everything possible to make a heat in as short a time as possible. The results of two tests using oxygen (tests A and B), and the normal heat (test C) are indicated in table I. The average of tests A and B as compared with the normal heat (test C) indicates a saving of time of about 24 pct, and an increase in tons output per hour (charge to tap) of about 36 pct. The fuel reduction from these tests is shown to be 35 pct, although other tests indicate a possible fuel saving of around 17 pct.

With the reduction in scrap melting time, by at least 2½ hr, scrap-handling facilities will have to be modernized in many shops in order to keep pace. Dominion Steel and Foundries, Hamilton, which has also participated in the experimental tests, is said to have a very efficient setup for rapid scrap charging—an arrangement of scrap storage to openhearth that all plants desiring to use oxygen will more or less have to follow.

Further, scrap charging must be more rapid than melting in order to prevent damage to the furnace lining. As long as there is cold charge present in the furnace, there is no danger to the roof or side walls. Hence, by accurate control in the timing of oxygen input, it is claimed that serious refractory troubles will not arise. Others claim, however, that in time, operators will not be satisfied with the moderate saving in time, and will attempt to further boost output—at which time refractory problems will assume serious proportions.

The opinion has also been expressed that not only the furnace refractories, but the entire checker system itself will have to be changed, since the outgoing gases will be hotter and will burn down present checkers, ends and arches. A contradictory expression is that it may be quite possible to some day build an openhearth furnace without checkers and obtain even higher efficiencies than is possible with existing units. Of course, although spot tests have shown increases in furnace output up to 40 pct, with no apparent effect on refractories, accurate figures cannot be obtained until a given furnace has been operated through a campaign using oxygen during the melting period of every heat.

An objection to the use of oxygen was raised by some metallurgists, who felt that the oxidation of the slag, and consequently of the steel, would be considerably increased. The tests conducted in Canada tend to dispute this theory, since it was found that the FeO content in the slag was 8 to 9 pct when using oxygen, as compared with 11.5 to 12 pct FeO obtained with conventional practice. Apparently, the shorter time of exposure of the solid scrap to the hot gases has been the controlling factor. Under proper adjustment there should be no excess oxygen after combustion.

Although the experiences of the Steel Co. of Canada have been with an oil-fired openhearth furnace (tapping 180 tons), experiments conducted in the United States wherein oil, tar, pitch and coke oven gas are being used, tend to give results along the same lines.

Another interesting application of oxygen is its introduction into a molten bath (both openhearth and electric furnace) for carbon reduction purposes. The work of H. C. Bigge was referred to previously. E. J. Chelius[5] reports the use of an oxygen lance in removing carbon from stainless steels produced in a 35-ton Heroult electric furnace (tapping 45 tons). He states that when the heat is two-thirds melted, a dried pipe is connected to a special lance and pushed through the wicket hole in either the side door or the charging door. The end of the pipe is inserted under the slag and the oxygen turned on. Keeping the end of the pipes just under the slag, the lance is fed slowly until it gets too short to use. About three lances are consumed per heat, with each lance lasting about 20 min. One lance will remove about 0.08 pct C on an SAE or other normal commercial steel.

A single test conducted by the Steel Co. of Canada on a 67-ton openhearth resulted in the carbon content being reduced from 0.58 to 0.09 pct in 24 min, using 6000 cu ft oxygen.

Other companies are, of course, also experimenting with the use of oxygen for refining purposes, but due to lack of conclusive data, hesitate to release data for publication.

Summary

It is apparent that much more experimental data must be compiled before any definite predictions can be made about the use of oxygen (less than 99.5 pct) in the steelmaking industry. While more and more information will be forthcoming in the near future relative to new oxygen applications, it is imperative that tests be conducted on a scientific basis—otherwise much of the data gathered will be worthless. Employment of oxygen in order to accumulate numerical data is not sufficient—basic chemical reactions, the methods of introducing oxygen, and all variables must be given a thorough and intensive survey so that operating conditions can be established on a strict engineering basis.

The various oxygen manufacturers, including Canadian Liquid Air, Air Reduction Sales Co., Linde Air Products, Hydrocarbon Research, Inc., and Air Products are maintaining active cooperation with the steelmaking industry in order that progress made by either the oxygen producer or the oxygen consumer can immediately be taken advantage of.

The cost of oxygen to the consumer will, of course, be an important factor in determining how long a time period will elapse before the use of oxygen in producing steel and pig iron becomes regular practice. Then again, it is up to the consumer to establish the optimum purity of oxygen required for his particular purpose—since this factor directly affects cost of oxygen production. It has been expressed by a prominent consumer (openhearth) that if oxygen of 98 pct purity can be produced in large volume for about 25¢ per 1000 cu ft (equivalent to $6 per ton), its arrival heralds great industrial changes. A large oxygen manufacturer estimates that prices will range from $6 to $10 per ton in large quantities for 90 pct purity—which is said to be about one-tenth of the present price. Costs involving production of oxygen must be scrutinized so as not to be misleading. For example, a cost of $3 per ton (90 to 95 pct) oxygen has recently been publicized. This figure does not include power and water costs, however, since the installation is operated in connection with a process for producing motor fuels, diesel oil and crude alcohols from natural gas—and power and water are both claimed to be available as byproducts of the process. A further economic consideration is that it is impossible to establish any definite price basis as the criteria for acceptance of the use of oxygen, since no two consumers (even among those making identical products) operate at identical costs—a price satisfactory to one may be impractical to another.

TABLE I

Operating Data for Open Hearth Tests Using Oxygen

ITEM	Test A	Test B	Test C
Total metallic charge, Lb	396,430	415,155	399,470
Hot metal, percent	41.9	43.5	41.6
Charging time hr-min	2-45	2-22	3-55
Time to addition of hot metal hr-min	3-18	3-09	5-20
Melt time hr-min	6-50	5-50	7-50
Total time of heat hr-min	8-10	9-05	11-10
Tons produced	179.10	188.95	174.95
Yield, percent	90.5	91.0	87.6
Tons per hour (charge to tap)	21.9	20.72	15.67
BTU (1000) per ton	2,939	3,486	4,346
Fuel as Gallons (U. S.) oil per net ton	19.49	23.11	28.8
Fuel rate as oil,—Gallons (U. S.) per hr	500	610	496
Slag, Actual FeO Pct	9.8	6.0	11.5
Rate of flow oxygen, cfm	700	800	None
Oxygen used, cu ft	155,700	165,500	None
Oxygen used, cu ft per net ton	873	877	None

REFERENCES

[1] W. Lennings, Stahl und Eisen, May 16 and 23, 1945, and Oct. 21, 1943.

[2] M. A. Shapsvalov, "Technical and Economical Fundamentals of Use of Oxygen Enriched Air in Blast Furnace." Teoriya I. Praktika Metallurgii, Vol. 9, No. 7-8, 1938. Brutcher translation.

[3] "Combustion of Coke with Oxygen Enriched Blast and Its Effect on Smelting," Archiv fur das Eisenhuttenwesen, March, 1943, Vol. 16.

[4] "My Trip to Russia," Langmuir, Chemical & Engineering News, Vol. 24, No. 6, Mar. 25, 1946.

[5] Electric Furnace Proceedings, AIME, 1945, p. 127.

A Periodic Chart for Electroplaters

By GEORGE DUBPERNELL

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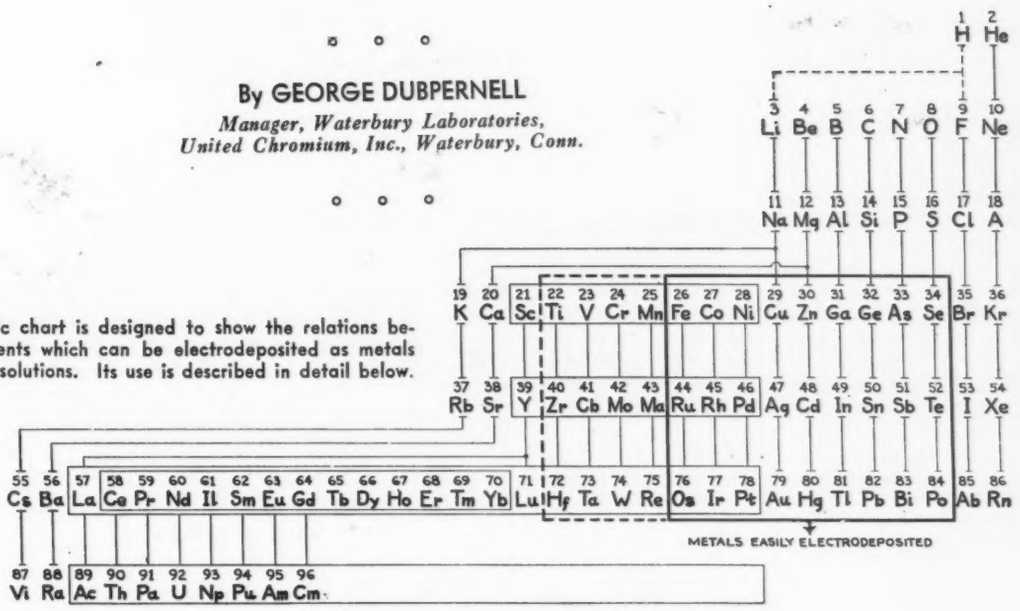
United Chromium, Inc., Waterbury, Conn.

THIS periodic chart is designed to show the relations between elements which can be electrodeposited as metals from aqueous solutions. Its use is described in detail below.


1 H
2 He
3 Li 4 Be 5 B 6 C 7 N 8 O 9 F 10 Ne
11 Na 12 Mg 13 Al 14 Si 15 P 16 S 17 Cl 18 A
19 K 20 Ca 21 Sc 22 Ti 23 V 24 Cr 25 Mn 26 Fe 27 Co 28 Ni 29 Cu 30 Zn 31 Ga 32 Ge 33 As 34 Se 35 Br 36 Kr
37 Rb 38 Sr 39 Y 40 Zr 41 Cb 42 Mo 43 Ma 44 Ru 45 Rh 46 Pd 47 Ag 48 Cd 49 In 50 Sn 51 Sb 52 Te 53 I 54 Xe
55 Cs 56 Ba 57 La 58 Ce 59 Pr 60 Nd 61 Il 62 Sm 63 Eu 64 Gd 65 Tb 66 Dy 67 Ho 68 Er 69 Tm 70 Yb 71 Lu 72 Hf 73 Ta 74 W 75 Re 76 Os 77 Ir 78 Pt 79 Au 80 Hg 81 Tl 82 Pb 83 Bi 84 Po 85 Ab 86 Rn
METALS EASILY ELECTRODEPOSITED
87 Vi 88 Ra 89 Ac 90 Th 91 Pa 92 U 93 Np 94 Pu 95 Am 96 Cm

A PERIODIC chart for electroplaters which brings the interrelations between the chemical properties of metals into clear focus and is thus of value in selecting the best bath for depositing a given metal is presented herewith. This chart is an adaptation of the Bohr-Thomsen or long-period type of periodic chart to show the relations between the elements which can be electrodeposited as metals from aqueous solutions.

The elements are arranged in numerical order according to their atomic numbers. Elements having similar properties are connected by lines. The transition elements in the longer series are enclosed in a light rectangle, as are also the rare earth elements in the longest series. Metals which can be easily electrodeposited with high current efficiencies are arranged in a single group enclosed by a heavy solid rectangle. Metals which are more difficult to deposit fall into another coherent group to the left of the first group; these have been marked off with a heavy dotted line rectangle.

The metals on the right hand side within the heavy solid rectangle tend to have nonmetallic properties but can also be easily electrodeposited in a metallic form. The only strongly colored metals are copper, No. 29, and gold, No. 79, to the left of the center of the group. The metals to the right of these are generally soft white metals which tend to give coarsely crystalline deposits, while those to the left are frequently obtained as hard or brittle deposits consisting of very fine crystals.

The plating baths most suitable for the metals adjacent to a given metal indicate the type of bath holding most promise for successful results with metal to be deposited. For example, the metals in the center of the group in the solid rectangle can all be plated well from cyanide solutions, and so cyanide baths would be strongly indicated for silver, cadmium, and indium.

There seems to be increasing difficulty in depositing the metals in the dotted line rectangle as one moves from right to left. The only metals in this group deposited dependably in the pure state appear to be manganese, chromium and rhenium. Much effort has been expended on the other metals in this group but largely without success. Molybdenum and tungsten have been plated as alloys with other metals. This group of metals difficult to deposit would appear to be the most fruitful field for electrodeposition research. Many of these so-called rarer elements are available in large quantities in the earth's crust.

This report is an abstract of a paper presented at the 33rd Convention of the American Electroplaters' Society.

All of the elements known up to the present are shown on the chart, including the last four recently discovered as a result of the atomic bomb work, neptunium, plutonium, americium and curium. Following the suggestions of Seaborg, these have been placed under the corresponding rare earth elements and the previously accepted strong connections between such metals as hafnium and thorium, and tungsten and uranium have been broken. This makes a simpler and more orderly chart, but the correctness of breaking the formerly accepted connections remains to be shown by later research. If this change was not correct, then plutonium, americium and curium should fall under osmium, iridium and platinum, and be easily electrodeposited and included in the solid rectangle. At present, the arrangement shown seems most likely to be correct.

Speakers' table at the annual ASM banquet, with C. H. Herty, Jr., retiring ASM president, presiding. At D[illegible]erty's l

. . . Metal Show Accents — Quality C

THE 28th annual metal congress and exposition, held the past week at Atlantic City, N. J., although competing with a neighboring conclave of CIO delegates and the balmy weather of the boardwalk, attracted the largest attendance of any previous metal show held in the east, with some 40,000 visitors reported to have visited the exhibition hall.

Marking the first truly peacetime meeting in some six years, the congress was devoid of military atmosphere and once again the emphasis of the technical meetings and the equipment exhibition was on the twin competitive problems of quality and high output. Sponsored jointly by the American Society of Metals, the American Welding Society, the metal divisions of the American Institute of Mining and Metallurgical Engineers, and the American Industrial Radium and X-ray Society, the metal congress held forth at the Municipal Auditorium and nearby hotels for the five days from Nov. 18 to 22.

The equipment exhibition, occupying two levels at the auditorium, covered some 400 individual exhibitors and, largely through numerous full size operating exhibits, stressed the general congress theme of quality control and increasing labor productivity by use of more efficient machines. A fairly active "buying interest" on the part of visitors to the displays served to keep most exhibitors fairly busy throughout the show.

The technical sessions were, as one metallurgist expressed it, "well and aggressively" attended, with many lively discussions springing up on controversial discussions. The ASM lecture series were particularly well received.

Election of officers at the annual meeting of ASM saw the following new officers chosen to head the society for 1946-47: President, A. L. Boegehold, head of metallurgy department, Research Laboratories Div., General Motors Corp., Detroit; vice-president, F. B. Foley, Superintendent of research, Midvale Co., Philadelphia; trustee, A. E. Focke, research metallurgist, Diamond Chain & Mfg. Co., Indianapolis; trustee, J. E. Dorn, associate professor of physical metallurgy, University of California. Bill Eisenman was reelected secretary.

The annual banquet, held Thursday evening at the Traymore Hotel, was highlighted by an address by Walter S. Tower, president, American Iron & Steel Institute, who spoke on the subject "The Layman Looks at the Metallurgists." Mr. Tower reviewed the role of metallurgists in the nation's economic life and pointed out some roles engineers may play in the future. In discussing the relative positions held by various ferrous and nonferrous metals and plastics, the speaker expressed the opinion that it did not seem likely that the light metals will ever replace the ferrous materials, largely because of the tremendous amount of research and development work being carried on by the iron and steel industry. C. H. Herty, Jr., assistant to vice-president, Bethlehem Steel Co., the retiring president of ASM, presided at the banquet.

Presentation of medals and awards at the banquet saw the following men honored. The Henry Marion Howe Medal for a paper of outstanding merit was awarded this year to C. R. Austin and M. C. Fetzer, coauthors of the paper "Factors Controlling Graphitization of Carbon Steels at Subcritical Temperatures." Dr. Austin is director of research, Meehanite Metal Corp., while Dr. Fetzer is associated with Carpenter Steel Co., Reading, Pa.

The Albert Sauveur Achievement Award was presented this year to E. C. Bain, vice-president in charge of metallurgy and research, Carnegie-Illinois Steel Corp. The award, established to acknowledge outstanding metallurgical achievement instrumental in causing basic advances in metallurgical knowledge, was due,

At D[illegible]erty's left is Walter S. Tower, president, American Iron & Steel Institute, the principal speaker at the dinner

Control and High Productivity . . .

Twenty-eighth Metal Congress sets new record for number of visitors attending an eastern show . . . Technical sessions stress quality and higher productivity . . . Equipment exhibit concentrates on peacetime problems for first time in seven years . . . Boegehold inducted as ASM president . . . Delhi heads AWS . . . Cota new president of X-ray group

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in part, to Dr. Bain's development of a new conception of heat treating, which resulted in the now familiar S-curve. This new approach to heat treating phenomena brought to light a new type of structure which has been designated bainite in honor of its discoverer.

The ASM Medal for Advancement of Research was presented to R. E. Zimmerman, vice-president in charge of research and technology, United States Steel Corp. Dr. Zimmerman's citation read, in part, . . . "he coordinates the research of a wide variety of the (U. S. Steel) corporation's enterprises in addition to iron and steel technology. In this domain is, particularly, the corporation's research laboratory at Kearny, N. J., the work of which has become famous throughout the world."

Delhi Heads Welding Society

The final session of the American Welding Society meetings was in the form of a business meeting and was highlighted by the induction of the new officers who will lead the society in 1946-47. The new president of the society is L. W. Delhi, vice-president of Hunt, Merck & Co., San Francisco. The society's new first vice-president is Harold O. Hill, assistant chief engineer, fabricated steel construction, Bethlehem Steel Co., Bethlehem, Pa., while the group's new second vice-president is George H. Sieger, president and general manager, S-M-S Corp., Detroit.

Mr. Delhi, the new president of the welding society, was formerly connected with Western Pipe & Steel Co. of California, serving 22 yr with that company. While at Western he served as vice-president in charge of shipbuilding operations and in this capacity was responsible for the construction of more than 48 special all-welded C3 type vessels.

James F. Lincoln, president, Lincoln Electric Co., Cleveland, was awarded the 1946 Samuel Wylie Miller Memorial Medal. This award is made each year by the welding society to the person judged most deserving for conspicuous contributions to the advancement of welding or cutting of metals.

The Lincoln Gold Medal awarded each year for a technical paper judged to have contributed most to the advancement of welding, was awarded this year to Harry E. Kennedy, Berkeley, Calif. The award was based on a paper entitled "Some Causes of Brittle Failures in Welded Mild Steel Structures." Mr. Kennedy is a coinventor of the Union-Melt welding process.

First and second prizes in the industrial division of the annual competition sponsored by the Resistance Welder Manufacturer's Association were awarded this year to Julius Heuschkel and Joseph J. Riley, respectively. The awards are based on the papers received by the welding society from an industrial source in which the major portion of the subject matter deals specifically with resistance welding.

Mr. Heuschkel, who is associated with Westinghouse Research Laboratories, East Pittsburgh, as research engineer, received first prize in the industrial division of the competition for a paper entitled "Selecting Spot Welding Schedules for Low Carbon Steels." Mr. Riley,

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A. F. COTA, A. O. Smith Co., Milwaukee, elected president of the American Industrial Radium and X-Ray Society.

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who is a sales engineer with Taylor-Winfield Corp., received second place prize in the competition for his paper on "Vibration of Spot Welds in Low Carbon Steel Over a Range of Welding Variables.

X-Ray Society Elects Cota

Al F. Cota, A. O. Smith Corp., Milwaukee, was elected president of the American Industrial Radium and X-Ray Society, at the society's sixth annual convention, which was held in conjunction with the National Metal Congress. Other officials of the radiographic group chosen at the meeting are: Vice-president, Don M. McCutcheon, Ford Motor Co., Detroit; treasurer, Dana W. Smith, Glenn L. Martin Co., Baltimore. Kent R. Van Horn, the retiring president, will serve the society as a director for one year. Philip

Varied Metallurgical Problems Explored at A

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A. L. BOEGEHOLD, head of metallurgy department, Research Laboratories Division, General Motors Corp., Detroit, chosen president of ASM for 1946-47.

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THE some 65 formal technical presentations and 31 educational lectures rounded out an intensive five days for ASM members, at the National Metal Congress held in Atlantic City last week. A wide variety of timely subjects, including high temperature alloys, steelmaking, physical testing, heat treatment, temper brittleness, and others too numerous to mention herein, were enthusiastically received, and were, on the whole, well-attended.

The Edward de Mille Campbell Memorial Lecture was presented this year by J. B. Austin, director, research laboratory, United States Steel Corp., who explored "The Effect of Changes in Condition of Carbides on Some Properties of Steel." Proposing that the iron framework of the cementite lattice is held together by bonds which are essentially metallic, Dr. Austin held that it should be possible to replace iron atoms by those of other elements to form alloy cementite analogous to alloyed ferrites and austenites. Chief among the conditions for replacement of iron in cementite, are that the solvent and solute atoms be chemically alike and that they differ by not more than 15 pct in size.

As regards the relative tendency of elements to form carbides, iron carbide in a pure iron-carbon alloy is a very weak compound. Indeed, it is thermodynamically unstable with respect to graphite; hence introduction of an element which is a still weaker carbide former—for instance, silicon or nickel—under most conditions merely promotes decomposition of cementite to graphite and iron. On the other hand, any of those elements which form relatively stable carbides; namely, titanium, vanadium, chromium, manganese, zirconium, columbium, molybdenum, tantalum, or tungsten, might be expected to stabilize cementite if it can fit into the structure.

Considering the composition of carbides formed on isothermal transformation, Dr. Austin referred to data that had been previously presented showing that cementite formed in the pearlite region is alloy-rich, whereas that formed in the bainitic region is

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E. C. BAIN, vice-president in charge of metallurgy and research, Carnegie-Illinois Steel Corp., awarded the 1946 Albert Sauveur Achievement award.

RIGHT

R. E. ZIMMERMAN, vice-president in charge of research and technology, United States Steel Corp., recipient of the 1946 ASM medal for advancement of research.

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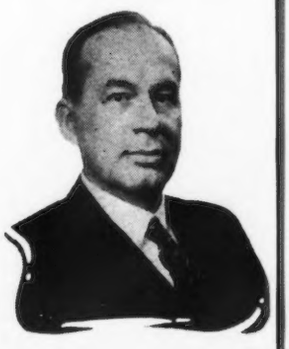

D. Johnson, national secretary of the society, was presented with a certificate and a gift to mark the group's appreciation of his efforts and accomplishments during the five years he has thus far served as national secretary.

Emphasizing the proper use of nondestructive testing methods for quality control rather than simply for inspection, the society's three-day meeting at the Seaside Hotel covered such subjects as quantitative measurement of penetrating radiation, commercial and research applications of radiography, radiation methods for fine structure analysis, nondestructive test methods and technique and diagnosis standardization. The society's 1946 Mehl lecture was given by H. E. Seemann, Eastman Kodak Co. Dr. Seemann's subject was "Photographic Aspects of Industrial Radiography."

One technical paper that attracted particular interest was "Radiography of Heavy Radioactive Materials," by G. H. Tenney of the Los Alamos Project. Dr. Tenney discussed in a general way the methods used to study some of the heavy materials used at the atomic bomb laboratory. He indicated that as much as 2 g of radium in one capsule has been employed as a source of radiation in studies of heavy materials such as uranium, this large quantity being required because of the radioactive qualities of uranium itself.

While space limitations prohibit discussion of all the excellent papers presented the Metal Congress, abstracts of a number of the papers are given in reports of various societies participating in the congress published elsewhere in this issue.

ASM Sessions . . .

A wide variety of metallurgical problems, including heat treatment, temper brittleness, inspection and testing, hardness and hardenability, to name a few, were thoroughly debated last week at ASM technical meetings. The effects of carbide conditions on steel properties were discussed by the Campbell Memorial Lecturer.

F. B. FOLEY, superintendent of research, Midvale Co., Philadelphia, installed as vice-president of ASM for 1946-47.

alloy-poor. Thus, in a steel containing 2.2 pct Mn, 0.14 C, and 0.18 Cr, cementite formed on transformation at 1022° F and subsequent spheroidization at 1256° F, contains about 18 pct Mn and 3 pct Cr—on the other hand, that formed on transformation at 752° F contains only about 4 pct Mn and a trace of chromium. Likewise, in steel containing 1.3 pct Cr, 0.36 C, and 0.31 Mn, cementite formed at 1202° F and then spheroidized at 1382° F contained 17 pct Cr and nearly 2 pct Mn, in contrast to that formed at 842° F which contained but 3 pct Cr and only about 0.5 pct Mn.

A number of properties of steel may be influenced by segregation of alloying elements in the carbide phase. One of these, secondary hardness, has been previously discussed by Bain; hence it was not discussed in detail by Dr. Austin. The speaker did, however, emphasize the effect of carbide composition on (1) resistance to creep at elevated temperature, (2) tendency to graphitize, and (3) susceptibility of steels to attack by hydrogen at high temperature and pressure. It is reasonably certain that creep strength is improved by precipitation of fine particles throughout the steel, though it has not been established that the particles need be carbides. The size and degree of dispersion of such particles may well be more significant than their composition, but one cannot ignore the possibility that progressive transfer of alloying element from matrix to carbide on holding at temperature may also be a factor. With respect to attack by hydrogen at high temperature and pressure, in the synthesis of ammonia and of certain hydrocarbons, steel is often damaged by decarburization, and by the appearance of cracks which are commonly ascribed to the formation of methane at high virtual pressure through reaction of carbide with hydrogen diffusing into the metal. Presence of an alloying element in the steel, or more specifically in the carbide, appears to stabilize the carbide with consequent alleviation of the attack. The effectiveness of an alloying element in preventing attack cor-

JOINT recipients of the Henry Marion Howe medal this year were C. R. Austin (right), director of research, Meehanite Metal Corp., and M. C. Fetzer (left), metallurgical department, Carpenter Steel Co., Reading, Pa.

relates directly with the degree to which it stabilizes cementite or form a more stable carbide.

Temper Brittleness

"A study of temper brittleness is essential if maximum properties are to be developed in steels used in heavy sections. In order to develop a fully-quenched and tempered structure in large sections, the hardenability of the steel must be high, but with increase in hardenability there will be an increase in susceptibility to temper brittleness. When the alloy content becomes too high, the impact properties of the steel will be low, regardless of heat treating practice, since the cooling rate of a large mass from the tempering temperature will be insufficient to prevent embrittlement even on a water quench. Thus, temper brittleness, instead of hardenability, will determine the alloy content of steels used in large sections."

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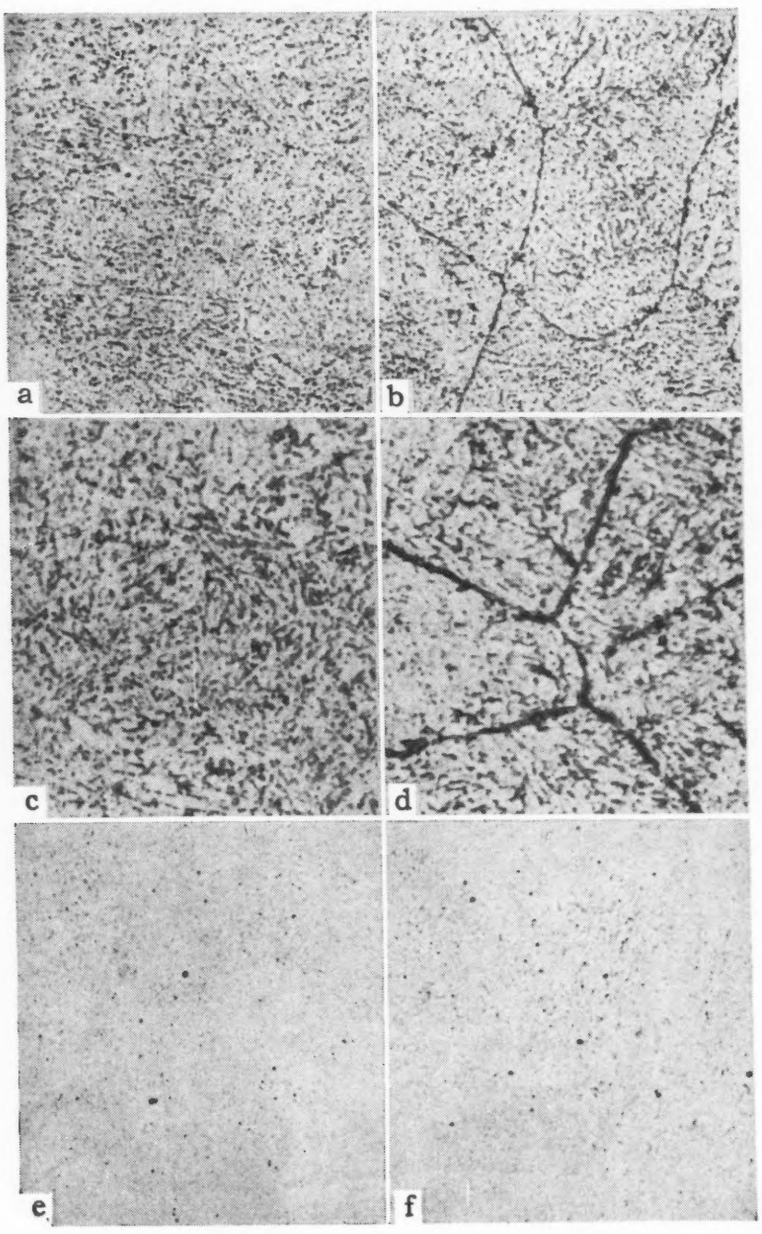
FIG. 1—Photo micrographs of cast steel No. 21. Micros A, B, E, and F X1000., micros C and D X2000.



In an effort to contribute to the meager information available on this complex phenomena, W. S. Pellini, metallurgist, American Brake Shoe Co., Mahwah, N. J., and B. R. Queneau, chief development metallurgist, South Works, Carnegie-Illinois Steel Corp., Chicago, studied the development of temper brittleness in two steels of widely different hardenability. In their report, "Development of Temper Brittleness in Alloy Steels," the authors discussed the effect of time at temperature in the temper-brittle range as compared with the embrittlement developed in the steels while cooling or heating through the same range of temperatures.

Of the two steels tested, steel B (0.44C, 1.64 Mn, 0.029 P, 0.022 S, 0.06 Si, 1.84 Ni, 1.64 Cr, 0.40 Mo, 0.15 V) has greater hardenability than steel A (0.33 C, 0.23 Mn, 0.013 P, 0.021 S, 0.06 Si, 3.78 Ni, 1.79 Cr). The effect of temperature on the development of temper brittleness in the two steels is illustrated in figs. 2 and 3. The values given are average Charpy impact energies (in ft-lb) obtained on duplicate tests made at –60°F. All specimens were tempered at 1200°F to a hardness of 230 Bhn, water quenched, held at the times and temperatures indicated, and again water quenched. Ductile fractures have been designated as "all fibrous," fractures having less than 50 pct of the fracture area crystalline have been designated as "mostly fibrous," fractures having more than 50 pct of the area crystalline have been designated as "mostly grain," while brittle fractures having a completely crystalline appearance have been designated as "all grain." Experience in notch bend testing has shown that the most important differences between specimens were the changes in the mode of fracture rather than the slight differences in fracture energies.

From the figures, it will be seen that the two steels have a maximum rate of embrittlement at about the same temperature (about 950°F), but the rate of embrittlement of steel B is greater than steel A, and also the embrittlement is in evidence at much higher temperatures for the former.

A study of the development of temper brittleness during continuous cooling through the brittleness range showed that for steel A the times and temperatures required to develop temper brittleness were approximately the same whether the embrittlement was induced isothermally or during continuous cooling. However, steel B showed marked embrittlement more rapidly on continuous cooling than when held at constant temperature in the temper-brittle range.

Further testing conducted with the two steels showed that with a tempered martensite structure the steel is somewhat more susceptible to temper brittleness than when the steel has a pearlitic structure.

Based upon their observations, the authors proposed (in contradiction to the theory proposed by H. Hollomon) that the precipitate responsible for temper brittlement is a carbide rather than a nitride

Etch for Temper Brittleness

The complexities of temper brittleness were further explored by J. B. Cohen, metallurgist, Miami, A. Hurlich, metallurgist, and M. Jacobson, chemical engineer, metallurgical engineering div., Watertown Arsenal Laboratory, Watertown, Mass., in their paper "A Metallographic Etchant to Reveal Temper Brittleness in Steel."

The authors found that the best results were obtained with an etchant with the following composition:

Picric acid	50 g
Purified ethyl ether	250 ml
Zephiran Chloride (12.8 pct sol.)	10 ml
Water	240 ml

The etchant revealed the general microstructural details of steels examined in the same manner as ordinary picral reagent, with the precipitated constituent responsible for temper brittleness definitely attacked. It was also found advantageous to repolish etched specimens on the final polishing wheel for about 1 min. The microstructural etch is removed by this procedure, but if the steel is in the temper-brittle condition, the pitting resulting from the etching of the embrittleing constituent will persist and provide a definite indication in a properly prepared and etched specimen.

J. B. AUSTIN, assistant director, research laboratories, U. S. Steel Corp., Kearny, N. J., the 1946 Campbell Memorial lecturer.

A typical example of the technique followed by the authors is illustrated in fig. 1. A cast steel (No. 21), containing 0.39 C, 1.33 Mn, 0.39 Si, 0.016 S, 0.013 P, 3.31 Ni, 1.58 Cr, 0.49 Mo and 0.035 Al was heat treated in different ways in order to produce a tempered martensite tough structure (fig. 1a) and a temper brittle structure (fig. 1b). The first specimen was water-quenched from the tempering temperature, while the latter was furnace-cooled from the tempering temperature. Both specimens were etched in the specially developed solution. Magnification is 1000X. Photomicrographs c and d represent a and b, respectively, at 2000X. The grain boundary attack is very definitely shown. The results shown in fig. d can be compared with the

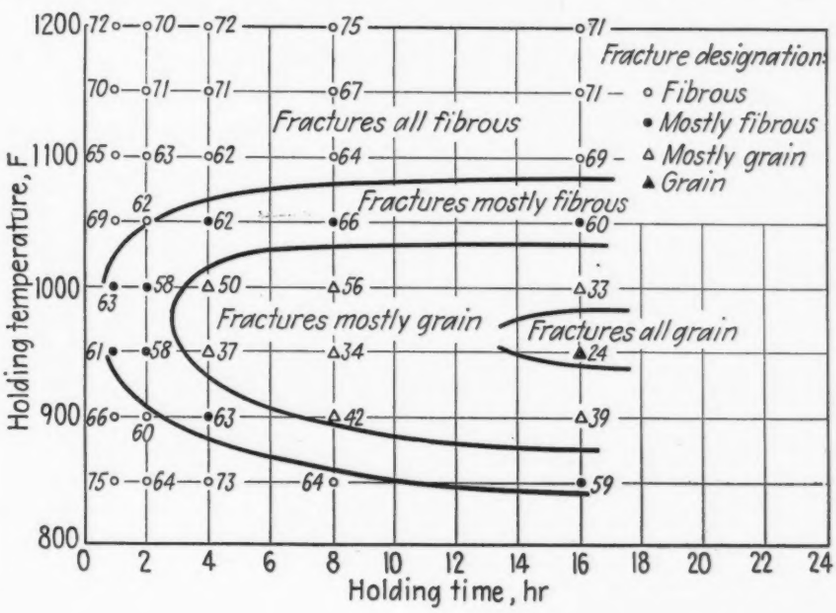


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FIG. 2—Effect of temperature on the development of temper brittleness in steel A.

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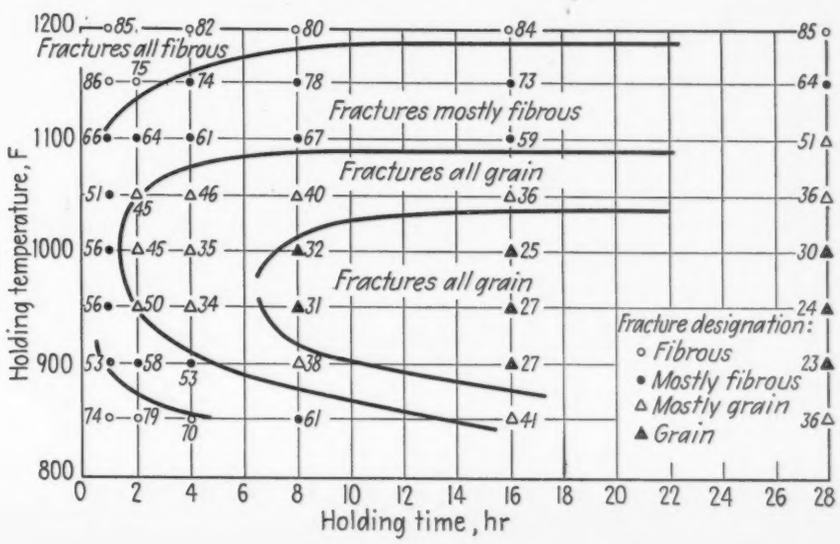
FIG. 3—Effect of temperature on the development of temper brittleness in steel B.



micros 4e and 4f, wherein the temper-brittle specimen was etched with Murakami's reagent and alkaline sodium picrate solution, respectively. Using these two etching reagents, no grain boundary segregation of carbides is evident.

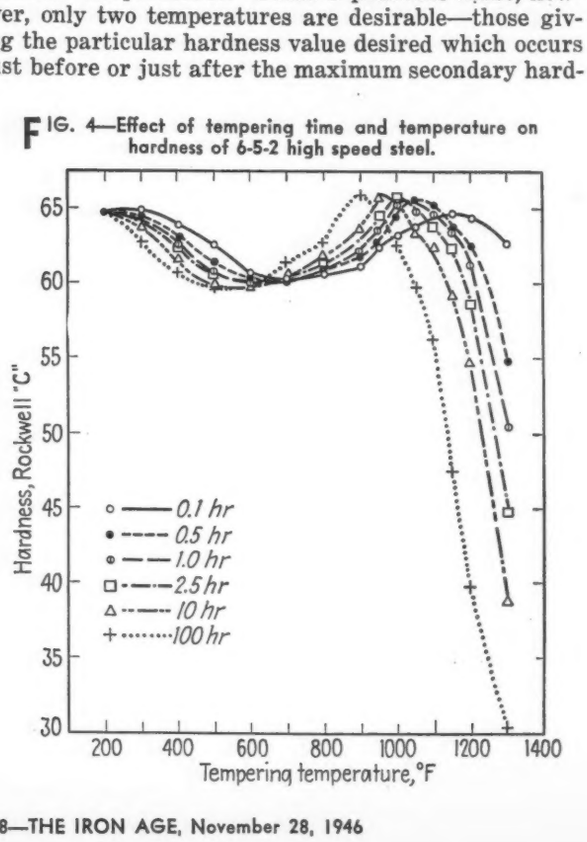
The authors also presented further photomicrographic evidence of the effectiveness of their etching reagent with other cast, rolled and forged steels. In the discussion it was pointed out that this is the first metallographic procedure to be successful in identifying temper brittleness in the form of grain boundary precipitation, and that it appeared that this method could be applied as a quick spot-check for determining existence of temper brittleness.

Heat Treatment of Tool Steels

Data that will offer material aid to the practical heat treater in solving the many problems confronting him with respect to heat treating tool steels is always enthusiastically received. Such was the case with the paper entitled "The Tempering of High Alloy Tool Steels," by G. A. Roberts, chief metallurgist, A. H. Grobe, research metallurgist, and C. F. Moersch, metallurgical dept., Vanadium-Alloys Steel Co., Latrobe, Pa. The authors' investigations on the effects of hardening temperature, tempering temperature and tempering time on hardness values were conducted using 10 highly alloyed tool steels, including high-speed steels, die steels for cold work and die steels for hot work.

The effects of tempering time and tempering temperature (when quenched from a single temperature) on the hardness of 6-5-2 high-speed steel are illustrated in fig. 4. An observation, common to all the tempering times involved, is that a particular hardness value, between the limits of about 60 to 65 Rc, is possible to obtain by simply tempering at three different temperatures. From a practical sense, however, only two temperatures are desirable—those giving the particular hardness value desired which occurs just before or just after the maximum secondary hardness value. Based on the information available in the fig. 4, it is possible to calculate and plot so-called "master tempering curves," wherein hardness is plotted against the parameter $T(\log t/t_o)$, equivalent to $T(c+\log t)$, where T is the absolute temperature, t the time and t_o and c constants of the steel.

FIG. 4—Effect of tempering time and temperature on hardness of 6-5-2 high speed steel.



The master tempering curves are valuable in that they will permit the selection of a variety of combinations of tempering temperature and tempering time to give any desired final hardness. This also applies for the multiple tempering cycles to produce a desired final hardness.

Of course, no discussion relating to heat treatment of tool steels is complete without involving the highly controversial issue, subzero treatment. L. E. Gippert, metallurgical dept., and G. M. Butler, Jr., associate director of research, Allegheny Ludlum Steel Corp., Dunkirk, N. Y., initiated an interesting floor discussion with their paper, "Changes in Size and Toughness of High Carbon—High Chromium Steels Due to Subzero Treatments." High carbon-high chromium types of tool steels are prone to retain large amounts of untransformed austenite during the hardening operation, and the decomposition of this by subzero treatment gives hardnesses which are unattainable by orthodox heat treatment methods. Such unusual hardnesses seem to be accompanied by at least enough toughness to warrant the suggestion that punches, blanking dies, forming rolls and other application of these steels might show longer life if given this treatment.

Cold treatment was shown by the authors to be most effective if no tempering operation precedes it, although standing at room temperature for as long as 24 hr will only moderately reduce the effect of the cold treatment. This was corroborated by W. E. Bancroft, chief metallurgist, Pratt & Whitney, who presented data based on retained austenite. He found that as-quenched 1 pct C 5 pct Cr die steel showed 30 to 35 pct retained austenite. Tempering at 340°F had no material effect in reducing this percentage, while tempering at 340°F and cooling to −120°F lowered the retained austenite to 28 pct (quenching temperature 1775°F). When the steel was cooled directly to −120°F, the retained austenite was lowered to 4 to 8 pct.

Reference to direct quenching raised the question of the danger of cracking. A statement by Mr. Bancroft that the danger of cracking is more theoretical than actual, was supplemented by a commercial heat treater who claimed that in 4 yr, not one die had been lost by direct cooling; that is, by placing the die into a −120°F cooler as soon as the die had cooled to about 150°F. The highly-stressed condition of the steel after direct quenching was emphasized with the observations that cracking was sometimes encountered in subsequent grinding operations. Cracking has also been noted around the impression made by the Rockwell hardness tester when hardness tests were made prior to tempering.

As regards the dimensional change accompanying cold treatment, the authors found that in some cases as much as 0.004 in. per in. expansion was realized. This growth must be included in die layout, and its magnitude is such as to offer possibilities of salvage when a die is found to be undersize after hardening, at least if this is discovered before tempering.

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LEFT

H. O. HILL, assistant chief engineer, fabricated steel construction, Bethlehem Steel Co., Bethlehem, Pa., elected first vice-president of AWS for 1946-47.

RIGHT

L. W. DELHI, vice-president, Hunt, Merk & Co., San Francisco, chosen president of AWS for 1946-47.

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Welding Engineers Stress Metallurgical Aspects

Technical papers presented before members of the American Welding Society at their 27th Annual Meeting and Exposition covered virtually all types and applications of welding, with emphasis on the design and metallurgical aspects. Digests of papers dealing with problems in welding tool and die steels, flashwelding high carbon steel wire, welding spring steel, weldability of wrought aluminum alloys, and welded design considerations, together with an outline of the Adams' Memorial Lecture, are presented herein.

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COINCIDENT with the National Metal Congress, the American Welding Society conducted its 27th annual meeting last week at the Ambassador Hotel, Atlantic City. A total of 79 technical papers were presented making it necessary to operate three simultaneous sessions each morning and afternoon. These were divided into major classifications under the headings of: Research, resistance welding, machinery, shipbuilding, cutting, structural work, welding alloy steels, pressure welding, aircraft, hardfacing, high alloys and miscellaneous. Highlight of these technical sessions was the annual Adams' Lecture, delivered by Wendell F. Hess, Rensselaer Polytechnic Institute, and retiring president of AWS. Speaking on "New Frontiers in Welding", Dr. Hess reviewed the developments that have taken place during the past few years in the various fields of welding, and emphasized that government-aided research, together with unprecedented war demands, had resulted in a greatly increased rate of development. These continued improvements, he said, must necessarily tend to raise the standard of living. Despite all the advances made to date, however, he reminded the audience that there were still many new frontiers to be explored. Resistance welding, for example, is tending to be applied to the heavier gages of metal, hitherto not considered suitable for this type of welding, while arc welding is similarly spreading to the thin gages. This constitutes a new frontier and opens up a broad field of research.

The use of structural aluminum alloys, Dr. Hess pointed out, is achieving new importance, and the necessity for proper surface preparation cannot be too highly emphasized. Mechanical cleaning, such as wire brushing, is not entirely satisfactory, and chemical action is generally preferable. Early efforts at spot welding were not too successful, he said, because of the cracking produced, but the development of new techniques and new equipment has made it possible to produce completely successful spot welds. Foremost among these improvements is the development of the double-pressure system whereby moderate pressure and low energy input are used at the start of the weld, and followed by high pressure to complete the operation. Trouble with sheet aluminum burning and sticking to the electrodes is still being experienced, he said, and expressed the hope that the mills might some day be prevailed upon to produce sheet which could be delivered to the customer in condition for immediate welding.

Another frontier, Hess said, exists in the spot-welding of hardenable steel sheet. Welds in this material tend to be extremely brittle, and loads applied at right angles to the weld may cause failure at only 5 pct of the shear strength of the material. Tempering of these welds, however, by means of a controlled current in the welding machine, can result in increasing the strength up to 40 pct.

Giving high praise to the manufacturers of arc-welding electrodes for improvements which have substantially reduced the cracking tendencies of arc welds, as well as to makers of spotwelding machines and electrodes, Dr. Hess reminded his hearers that while each new development was a forward step, each in turn opened up new frontiers for still further development.

Arcwelding Tool Steel

In a paper presented by A. R. Butler and F. E. Kessler, president and field engineer, respectively, Welding Equipment & Supply Co., Detroit, the authors pointed out that the arcwelding of tool steel is actually a hardening process. The coated electrodes utilized are in an annealed state and the weld metal is hardened by air quenching from the high heat of the arc. Weld deposits, however, can be annealed to facilitate

LEFT

J. HEUSCHKEL, research engineer, Westinghouse Research Laboratories, East Pittsburgh, awarded first prize in the 1946 Resistance Welder Manufacturers Association's prize contest for outstanding technical papers from industrial sources.

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J. J. RILEY, sales engineer, Taylor-Winfield Corp., recipient of second prize in the AWS contest for outstanding papers from industrial sources.

machining and afterwards heat treated and tempered. Tool steel welding, therefore, should not be confused with hardfacing since hardfacing materials will not as a rule respond to heat treatment because of their high alloy content. Tools that fail in operation can be welded, either partially or wholly, resulting in a minimum of down time. The confining of repairs to immediate faulty areas reduces expense incidental to spotting in and regrinding over entire working areas. Dimensions are retained within close limit and the use of inserts is eliminated. Valuable heat-treating time is saved, as weld deposits of tool steel welding electrodes are hard and welded. In most cases, subsequent heat treatment, other than tempering, is not necessary if the units lend themselves to grinding.

Two, three or even four types of tool steel electrodes can be applied on one die unit, eliminating the use of inserts which sometimes are impractical or unsatisfactory on large units and impractical on small ones. This permits one die unit to perform various functions, which would ordinarily require separate die units and separate operations. The practice of reclaiming or repairing tools and dies by welding results in longer life of plant equipment. Welding also permits changes in design of units during die tryouts or die changeover. Sometimes it is impractical or impossible to construct a die out of one type of tool steel if the die must perform individual functions such as one must trim, form, or restrike. It is impossible to secure composite tool steels in one unit with the qualities necessary to perform each of these operations. Therefore, it is very beneficial that this accomplishment can be made by welding on the cutting or working areas depositions having the desired characteristics to perform each individual operation.

Manufacturers of tool and die welding electrodes furnish technical information pertaining to their products and their uses. However, there is other knowledge that can be acquired by those engaged in tool and die welding that will prove to be very helpful and some knowledge of the basic mechanical principles and fundamental operating details of tools and dies should be acquired.

It has been determined that in practical tool and die welding it is not necessary that the electrode used be the exact match of the analyses of the tool steel being welded. However, in most cases the welding electrode used should match the heat treatment in its classification as closely as possible. Therefore, knowledge of the basic principles of fact in connection with heat treatment will be helpful.

In spite of the many different trade names of tool steels, there are only four classifications as far as welding is concerned: Water hardening tool steel; oil hardening tool steel; air hardening tool steel; and hot-working tool steel. While there might be wide variations in analyses of tool steel the basic heat treatments in their classification are similar. Therefore, in welding it is not a question of matching the analysis of the steel, but of matching the heat treatment in its classification as closely as possible.

Tool and die welding electrodes on the market can be divided into two distinct categories. In the first group are the basic tool steel welding electrodes such as water hardening; oil hardening; air hardening, including high speed steel; and hot-working. These are alloyed with various elements and are ferrous in character. The second group are classified as alloy welding electrodes used on cast draw and forming dies as well as on forging dies. As a general rule weld deposits with tool steel welding electrodes will respond to the heat treatment recommended for the average tool steel in its classification.

The alloy welding electrodes used for tool and die repair are varied in nature. The pure nickel, copper-nickel, and monel electrodes are generally used as a foundation on cast structured units preparatory to facing with other alloy electrodes of the chromium-nickel variety. Alloy welding electrodes which are used for tool and die welding, because of their high alloy content, will not respond to any heat treatment, and hardening is effected only through the work hardening of the depositions.

There are two types of high speed steel welding that are commonly used for oxyacetylene welding of high speed steel cutting tools as well as for compositely fabricating cutting tools. One type is a cast ferrous alloy that incorporates the characteristics of high speed steel from the standpoint of toughness and at the same time provides the wear resistance of cemented carbide. The weld deposits have cutting qualities of cobalt tungsten high speed steel. Hardness secured as welded and drawn approximate 60 to 66 Rc. The weld deposits have exceptional red hardness and resistance to abrasion. The cast alloy rods are recommended for applications requiring the maximum resistance to abrasion such as on lathe centers, centerless grinder rests, spinning tools, etc.

The other type is a cobalt-molybdenum-tungsten

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J. F. LINCOLN, president, Lincoln Electric Co., Cleveland, awarded the Samuel Wylie Miller Memorial Medal by AWS.

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H. E. KENNEDY, Berkeley, Calif., recipient of the AWS Lincoln Gold Medal.

high speed welding rod which is a drawn wire. This type is easy to apply because the drawn structure tends to eliminate porosity in weld deposits which is sometimes experienced in applying the cast alloys. The weld deposits secured with these welding rods have excellent cutting properties comparable to or excelling the typical high speed steel, combined with excellent abrasive resistant qualities. The hardness secured with the welding rods of this type will approximate 61 to 65 Rc. Contours are more easily maintained in utilizing the drawn rod than the cast rod. This minimizes the grinding necessary after welding. The drawn structure of these rods also minimizes the susceptibility to embrittlement and the weld deposits will take heat treatment similar to the typical high speed steels.

Design for Resistance Welding

I. A. Crawford, Ex-Cell-O Steel Products Co., Detroit, in his paper, "Design for Resistance Welding," emphasized that the efficiency of a resistance welding program depends upon a well planned organization capable of directing the engineering staff in the design for resistance welding.

The materials used in the assembly will, he said, control the type of resistance welding equipment required and in turn will determine the power requirements. Certain metals have not been successfully resistance welded, therefore, it is necessary to select the type of metal that is weldable. The thickness of the metal, the shape and size of the assembly must be considered when designing for resistance welding. All joints to be welded must be accessible, and where possible, the two pieces of metal being welded must be of uniform thickness. In designing the assembly, the importance of having uniform metal thickness must be kept in mind so that time can be saved due to the fact that the operator will not have to continually change the heat control for the proper weld time.

It is not always possible to design the assembly with ideal joints, therefore it is necessary to utilize other welding methods in conjunction with resistance welding. The joint must be so designed that the welding can be performed without undue handling of the assembly or of the welding equipment being used. The type of equipment used depends upon the size of the part being welded. If the assembly is too large or of irregular shape, subassemblies can be resistance welded and the final assembly arcwelded.

It is of prime importance, Mr. Crawford said, that each resistance welding job be properly recorded for future reference, not only in checking quality but in ascertaining machine settings on future welded assemblies. A job record card can be made giving all pertinent information such as material specifications, condition of material surfaces, type of equipment, tap settings, pressures, weld time, weld appearance, etc.

The latest type of equipment, the most complicated controls, expensive tooling, the best designed fixtures and the most complete welding information are not in themselves sufficient to guarantee a quality product if the design of the product itself has not been developed and proved for resistance welding.

Pressure Gas Welding of Tubing

In their paper, "Pressure Gas Welding of Alloy Steel Tubing", the authors, J. L. Zambrow and R. D. Williams, welding engineer and assistant supervisor, respectively, Welding Research Div., Battelle Memorial Institute, Columbus, Ohio, described an investigation of the factors which control the quality of oxyacetylene pressure welded joints, in thick-walled high strength alloy steel tubing, using the closed joint method.

After describing the design and construction of the welding machine and auxiliary equipment, the authors reported that it was possible to produce unreinforced joints which were equivalent in strength to the parent metal even when heat treated to high tensile strengths of 150,000 to 190,000 psi. In consistence, however, the welding technique was not entirely satisfactory for these high strength levels, and they reported that it would be fairer to state that the maximum consistent strength level established by their experiments would be of the order of 150,000 psi.

Inability consistently to produce joints equal in strength to the parent metal, was attributed chiefly to an oxidized zone of weakness at the weld plane. However, when the severity of the test conditions was considered, the results obtained were very encouraging and it was felt that had more time been available a method of effectively eliminating the oxidized zone might well have been developed.

The authors indicated that strong joints equal or superior to those made by other common welding processes could be obtained, and when the advantages of relatively high production speeds, and relatively

low initial equipment costs were also considered it was apparent that the process had considerable promise.

Flash Welding Steel Wire

R. W. Bennett and R. D. Williams, welding engineer and assistant supervisor, respectively, Welding Research Div., Battelle Memorial Institute, Columbus, Ohio, described in considerable detail a process developed for welding cold-drawn high carbon steel wire having a tensile strength of 220,000 psi in which the resulting joint had 90 pct of the parent metal strength. Flash welding was considered to be the most logical welding method because of its ability to produce strong efficient butt welds at high rates of production and low cost. The resulting welds, however, were hard and brittle because of rapidly cooling the high carbon steel wire. Therefore, an automatic heat treatment of welded joints was developed to transform the austenite in the weld zone directly into soft and relatively ductile pearlite. This was accomplished in the welding dies immediately after upset by arresting the cooling of the joints at about 1000°F and maintaining that temperature until the desired structural transformation had been completed.

The applicability of this process to production has been proved by hundreds of experimental welds which have been made and tested to destruction. These joints have consistently shown tensile strengths of about 200,000 psi which is about 90 pct that of the cold-drawn wire, while bend tests have shown that the weld zone maintained adequate ductility when properly post heat treated. In addition to the weld made in the laboratory, thousands of joints have been made on a production basis at rates exceeding one weld per min. These have stood up well under actual service conditions.

Welding Spring Steel

In a paper discussing the welding of spring steel to low carbon steel, Arthur Willink, professional engineer, Trenton, N. J., pointed out that conventional spot welding practices will not yield satisfactory results in this difficult and somewhat unusual operation. He quoted as an example the manufacture of a spring snap such as is used in harness hardware. Such items are usually assembled by means of a rivet, but it was evident that if resistance welding could be successfully applied, the product would be improved and the cost lowered.

First trials were made with about 650 lb of welding pressure on the lowest heat of a 15 kva spotwelder with a pulsation weld of four 12 cycle welds with a cool time of 6 cycles between. The results were not too encouraging as the springs became brittle, causing them to break. Heating subsequent to the welding operation was tried, but without success. Separate heat treatment was tried, but resulted in unserviceable springs. A study of what actually occurred during the welding cycle revealed that the spring at the weld, and the immediately surrounding metal, was at welding heat well above the critical temperature upon completion of the weld. The water-cooled electrodes, however, exerting pressure on the work, withdrew heat so rapidly after the welding current was shut off that they acted as a drastic quench before the work could be ejected from the machine. The solution lay in ejecting the work with the temperature well in excess of the critical, and with the spring surrounded by a suitable volume of metal also above the critical temperature.

Increasing the welding current and/or the welding time did not bring about the desired conditions, but produced burning and caused severance of the spring. By decreasing the pressure to 350 lb, it was found that a satisfactory weld was produced, and the work could be ejected with the spring temperature well above the critical, and enclosed in a sandwich of metal likewise above the critical.

In another type of snap, the sandwich type of design could not be used, and the spring was to be welded to the low carbon steel with one face in direct contact with the welding electrode. In this case a low pressure was again used, the mild steel being in contact with the lower electrode and the spring in contact with the upper electrode. By means of a solenoid the operation of the upper electrode was so controlled that it was released the instant the welding operation was completed. This precluded any drastic quenching action on the part of the electrodes. Many similar operations, involving the welding of springs, can be performed, Willink said, provided care is taken to prevent quenching action by the rapid withdrawal of heat through the electrodes.

Weldability of Aluminum

Discussing the "Weldability of High Strength Wrought Aluminum Alloys," William R. Apblett, Jr., metallurgy division, Naval Research Laboratory, Washington, D. C., pointed out that the ideal weld in any material is one in which the properties of the heat-affected zone and the weld metal are equal to or better than that of the base metal. The ideal is, however, difficult to attain, he said, when welding the present high-strength wrought aluminum alloys since the heat produced during welding has deleterious effects on the base metal. Fusion welding produces a material of considerably reduced strength and embrittles the metal in the area adjacent to the weld. The welding heat may cause intercrystalline precipitation in the heat-affected zone which subsequently gives rise to intercrystalline corrosion attack.

The welded structure consists of four distinct zones: (1) The unaffected base metal, (2) the heat-affected zone, (3) the partially fused zone and (4) the cast zone. Alloys such as those used in this investigation are useful because they combine high strength and fair ductility with good corrosion resistance and light weight. Since these properties are obtained by means of a combination of rolling and heat treatment, welding may be expected to seriously affect these alloys.

In the high-strength wrought aluminum alloys the requisite strength is brought about by heat treatment depending essentially upon the precipitation of constituents held in metastable solid solution in the alloy. Heating an alloy which is in the precipitation hardened condition will lower its strength either by re-solution of the precipitate or by the coalescence of the precipitate, so that it forms comparatively large particles which materially reduce the hardness of the material. Coalescence will take place prior to resolution and, therefore, in a material which has been heated to its melting point, a variety of structures will result. Two distinct zones are normally present, the author pointed out, a softened zone due to coalescence of the precipitate (over aging) and a hardened zone nearer the

weld due to re-solution and subsequent age hardening at room temperature.

The partially fused zone is of particular importance when welding the high-strength wrought aluminum alloys because a duplex structure is formed, one phase of which is concentrated at the grain boundaries and melts at a lower temperature than the other. Such a structure is also found in the casting alloys and may even be present in commercially pure aluminum that has been subjected to welding heat. When the melting temperature of this zone is very low, and when welding under restraint, cracking may be expected.

The cast zone is essentially a chilled casting since the surrounding base metal is a very good conductor of heat. Its structure will, therefore, usually be columnar. As in other casting operations, the action of the atmosphere on the molten fluidity, surface tension and the solidification process, including segregation and shrinkage, play important roles. Hence, in considering the problem of welding a wrought alloy, it is necessary to study the casting characteristics of that alloy and the properties attainable in the cast weld metal. Since aluminum-silicon alloys are well noted for their excellent casting characteristics and freedom from hot-shortness, it was this type of alloy that was selected for electrode use.

One of the most common sources of trouble encountered in the welding of aluminum alloys is gas porosity in the cast zone resulting from the reaction of the molten metal with traces of water that exist in either the atmosphere or the electrode flux coating. Since most of the coating materials are hygroscopic, exposure of the electrodes to the atmosphere usually results in high moisture content in the electrodes. The molten metal oxidizes rapidly in welding and the arc readily decomposes water vapor. Hydrogen set free in this reaction dissolves in the molten metal which has a comparatively high affinity for hydrogen. As the weld metal solidifies, the solubility of the hydrogen decreases and the gas is rejected, to rise as bubbles and escape or to be entrapped in the solidifying metal, forming porosity. Thus, the rate of cooling determines to a large extent the amount of porosity in the weld. If special precautions are taken to remove moisture from the surface of the base metal by use of a low preheat and from the flux coating by baking the electrode for several hours at 250 to 300°F, welds can be produced comparatively free from porosity.

In summing up, Apblett noted that, in general, the cast structure of the weld metal itself as deposited with commercially available aluminum electrodes constitutes the weak link in weldments of the aluminum alloys investigated. However, the presence of a relatively low-strength overaged zone adjacent to the weld also materially affects the weldment. Furthermore, a low melting point constituent concentrated at the grain boundaries in the partially fused zone contiguous to the weld may lead to cracking during cooling.

While the electrode used is suitable for welding the low and medium strength aluminum alloys, it does not possess sufficient strength to be suitable for use in the fabrication of structures designed to utilize the high strength of the alloys. Future investigations should be directed toward (1) the development of alloy electrodes which will deposit weld metal with better mechanical properties and (2) the development of more weldable aluminum alloys; i.e., alloys which are relatively unaffected by welding and which have a strength in the as-cast condition comparable to that in the wrought condition.

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Metal Show Memories

Courtesy Lindberg Engineering Co., Chicago

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LINDBERG FURNACES
MY WIFE THINKS THE FURNACES IN YOUR TOOLROOM HEAT-TREATING DEPARTMENT COULD BE SHIFTED AROUND INTO A MORE ARTISTIC ARRANGEMENT!
THAT STEAK I HAD FOR LUNCH WOULD HAVE BUSTED THAT HARDNESS TESTER!
WHAT DO YOU BOYS THINK OF CONTINUOUS QUENCHING?
I'M A MODERATE DRINKER, MYSELF!
FOLLOW ME, GILROY, I'VE FOUND A PLACE THAT SELLS WHITE SHIRTS!
SOME NICE EXHIBITS UP HERE THIS YEAR!
YEAH.... VERY INTERESTINGLY ARRANGED, TOO!
DON'T TAKE ON SO, DIGBY, ...YOU CAN'T EXPECT TO FIND BATHING BEAUTIES UP HERE IN NOVEMBER!
REMEMBER, WE'RE NOT UP HERE FOR WINE, WOMEN AND SONG!
WHO'S SINGING?!

Metallurgical Engineers Emphasize Basic Research

Emphasizing the importance of intensive basic research, the fall meeting of metals divisions of AIME covered metallurgical problems ranging from atomic structure and multiaxial stresses to vacuum arc melting of molybdenum, the effects of various alloys and sponge iron production.

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FEATURING a program of technical discussions ranging from electrons to multiaxial stresses and vacuum arc melting of molybdenum, the fall meeting of the Iron and Steel Division and the Institute of Metals sections of the American Institute of Mining and Metallurgical Engineers, held last week at Atlantic City in conjunction with the National Metal Congress engendered an unusually intense interest on the part of the members attending the meeting.

From the standpoint of attendence and apparent interest, one of the highlights of the meeting was the joint symposium on "Effects of Multiaxial Stresses on Metals." This symposium included papers on work hardening and rupture in metals, a comparison of various structural alloy steels by means of the static notched bar tensile test, plastic flow of aluminum alloy sheet under combined loads, mechanical equation of state, and a statistical theory of fracture, to name a few of the subjects covered.

Another highlight of the meeting was the 1946 annual lecture sponsored by the Institute of Metals Division and delivered by William Hume-Rothery of Oxford University to an audience of about 900. In his lecture, "Electrons, Atoms, Metals and Alloys," Mr. Hume-Rothery reviewed some of the advances in the theory of the structure of alloys made in the period between the two world wars. "These years were of outstanding significance," he said, "in the history of metallurgy, in which the development of new and more accurate experimental methods has led to the revelation of many new facts that may be said to have established some of the foundations of metallurgical science."

In the lecture, Mr. Hume-Rothery began with the first steps in X-ray crystal analysis, when copper had been found to crystallize in the face-centered cubic structure, and reviewed more recent discoveries and theories which, he said, still leave so many metallurgical problems yet to be answered.

Most of the illustrative examples of metallurgical progress described by Mr. Hume-Rothery were those in which one factor—the electron concentration, the size factor, or the electrochemical factor—can be seen clearly. He showed how in some cases the way can be seen in which the effect of one factor is gradually influenced by the increasing effect of a second factor. In general, however, all these factors and probably others also are at work together and science has not yet learned to deal with the combined problem quantitatively.

In extending the application of the calculation of hardenability to the quenched and tempered condition in which steel is finally used, Walter Crafts and John L. Lamont, Union Carbide and Carbon Research Laboratories, Inc., have reported in the Metallography session of the Iron and Steel Division a survey of the hardness changes caused by tempering in a paper on the "Effect of Alloys in Steel on Resistance to Tempering."

From this study a method has been evolved for the prediction of hardness and tensile strength of steel in the tempered condition. This calculation is accurate within about five Rockwell C hardness units, or 15,000 psi in tensile strength, and is suitable as a guide in the prediction of hardness and strength for relative evaluation and selection of alloy steels.

The formula indicates that tempered hardness is primarily dependent on as-quenched hardness and that the progress of tempering is controlled mainly by the carbon content. Alloys exert their full resistance to softening only in steels hardened above a critical level. With increasing tempering temperature, the degree of softening of hardened steel depends on carbon, except for the effect of nickel and except as softening is arrested in characteristic temperature ranges by the secondary hardening effects of silicon, manganese, chromium, molybdenum and vanadium. Secondary hardening appears to be associated with the transition of the alloying element from ferrite to carbide.

The amounts of alloy that retard softening by one Rockwell C unit after 2 hr at the higher tempering temperatures are: 0.40 pct Mn, 0.22 pct Si, 0.19 pct Cr, 0.77 pct Ni, 0.06 pct Mo, and 0.03 pct V (0.30 pct carbon steel).

The relative effects of alloys in resisting softening are materially different from their relative effects on hardenability, so that after the same heat treatment, steels of equivalent hardenability but different composition may vary considerably in tempered hardness and tensile strength. The ratio of softening resistance to hardening power of alloying elements increases in the following order: Boron, carbon, manganese, nickel, chromium, molybdenum, silicon and vanadium.

Boron in Some Alloy Steels

A study of the effects of the substitution of boron for a proportion of the molybdenum content of cast and wrought nickel-chromium-molybdenum and manganese-molybdenum steels was reported by M. C. Udy and P. C. Rosenthal, Battelle Memorial Institute (the latter is now Associate Professor, Department of Mining and Metallurgy, University of Wisconsin) at the Metallography session of the Iron and Steel Division.

From the standpoint of hardenability, boron added as ferroboron or as an intensifier alloy replaced at least 0.20 pct molybdenum in cast or wrought steels of these two types originally containing 0.40 pct Mo. The reaction of boron when added as ferroboron to aluminum-killed steels was not quite the same in the

cast steels as in the wrought steels when the boron addition exceeded 0.0015 pct. With an addition of 0.003 pct or more boron to the cast steels, their end-quench curves assumed a higher end-hardness, but dropped off more rapidly than the curves for any of the boron additions to the wrought steels or with the 0.0015 pct B addition to the cast steels. The best results with boron were obtained with additions of 0.0015 to 0.002 pct.

The boron additions had no apparent adverse effect on notched bar toughness at temperatures down to −80°F., whether added to steels of high or low molybdenum contents. The manganese-molybdenum steels proved to be slightly inferior to the nickel-chromium-molybdenum type, particularly in the wrought steels.

No direct effect of boron content on susceptibility to temper brittleness was evident. At least 0.10 pct Mo was necessary in the wrought nickel-chromium-molybdenum steel to overcome temper brittleness; whereas at least 0.20 pct was required in the wrought manganese-molybdenum type and in the cast steels of both base analyses.

As molybdenum increased, the tempering temperature required to reach a fixed hardness also increased. This effect was not found with increasing boron additions.

The test results presented indicate that a boron addition of 0.0015 or 0.003 pct can be used to replace half of the molybdenum in aluminum-killed steels of the following average base compositions: (1) 0.30 pct C, 0.85 Mn, 0.50 Ni, 0.50 Cr, 0.40 Mo; and (2) 0.30 pct C, 1.60 Mn, 0.40 Mo.

Full deoxidation of the melt was found to be necessary to avoid inconsistent hardenability results from the boron addition. This was just as true for the intensifier alloys used to add the boron as for the ferroboron. In cast steels, deoxidation with aluminum prior to a boron addition also prevented an unfavorable distribution of the sulfide inclusions.

Vacuum Arc Melting of Molybdenum

A technique was described at an Institute of Metals meeting which permits the melting and casting of molybdenum, together with details of a special process to make the molybdenum casting ductile. The development, presented in a paper by Robert M. Parke and John L. Ham of the Climax Molybdenum Co., "The Melting of Molybdenum in the Vacuum Arc", offers promise of the production of this high melting point metal at reasonable cost.

In the past molybdenum has been considered too refractory to be melted in commercial quantities and has, therefore, been formed into rod, wire and sheet by means of powder metallurgy in which the required temperatures do not exceed 90 pct of the melting temperature. However, this practice is of limited utility due to considerations of cost and size.

Two simple and effective methods for melting and casting molybdenum in a vacuum low-pressure arc were described. In one method the melting stock consists of pressed and sintered molybdenum bars. By the other method five operations are coordinated to form a molybdenum casting from powder, shown in fig. 1. These include: (1) pressing the powder into a continuous rod; (2) partially sintering by resistance heating; (3) melting the end of the rod in the electric arc; (4) deoxidizing the molten molybdenum with carbon added to the powder; and (5) melting in a water-cooled copper mold.

The use of the vacuum arc is adaptable to the production of molybdenum castings weighing at least 25 lb and appears to be adaptable to castings much larger. Not more than one kwh is said to be required to melt and deoxidize a pound of molybdenum.

It has been found necessary to add a deoxidizer to all commercial grades of molybdenum to obtain castings suitable for hot-working. The addition of about 0.01 pct C is usually sufficient to deoxidize during the melting process. For hot-working, the cast molybdenum bars were heated in vacuum to forging temperature (2552° - 2822°F) by high frequency induction. Withdrawn into the air they are worked in a two-die swage for which the dies were forced together on a 750-lb air hammer. They were designed to place a large portion of the bar under hydrostatic pressure and thus have an action similar to that of extrusion.

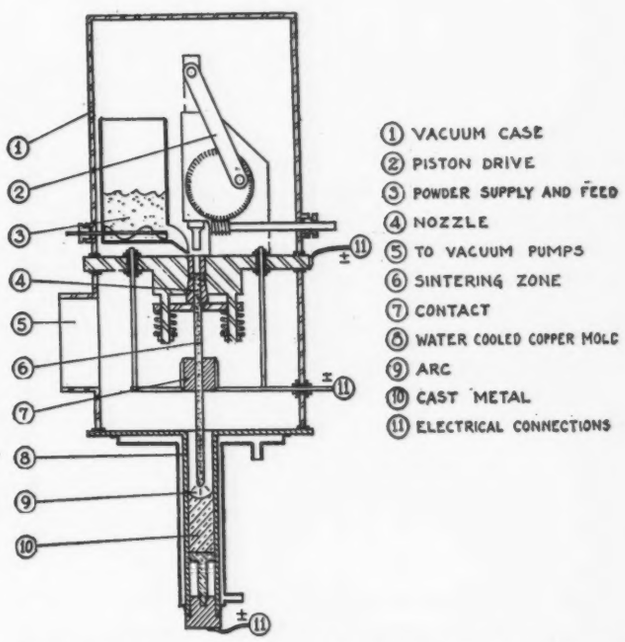


FIG. 1—Vacuum arc unit for melting and casting molybdenum iron powder.

By using a copper casting mold, externally water-cooled, the portion of liquid molybdenum next to the mold surface can be solidified quickly and cooled to a relatively low temperature. Thus, the immediate container of molten molybdenum soon becomes the solidified molybdenum at the surface of the water-cooled container. Therefore, the container is not in contact with the liquid molybdenum long enough for its surface to attain the high temperature of the melting process. Copper is an ideal material for the container because of poor weldability to molybdenum and its high thermal conductivity.

Low-Sulfur Sponge Iron

Pilot plant tests have demonstrated that it is possible to produce low-sulfur sponge iron (0.03 to 0.05

pct S) as a continuous process in an internally fired rotary kiln from from iron ore or mill scale with any solid carbonaceous reducing agent and sized dolomite to control the sulfur content. This development in sulfur control for sponge iron produced by this method which improves its desirability for use as melting stock for electric and openhearth furnaces was discussed by R. C. Buehl, E. P. Shoub and J. P. Riott of the Bureau of Mines Central Experiment Station, Pittsburgh, in a paper on the "Production of Low-Sulfur Sponge Iron," read at a meeting of the Iron and Steel Div.

In previous tests utilizing the rotary kiln for the production of sponge iron, the sulfur content usually exceeded 0.1 pct unless reducing agents with very low sulfur contents were employed. Yet the rotary kiln method has the advantages of simplicity and low cost of equipment, and requires little labor for the operation of the process.

The development of the use of sized dolomite (−20+100 mesh) as the desulfurizing agent resulted from an investigation of the form in which sulfur exists in sponge iron and of the factors that influence the transfer of sulfur into the sponge iron when solid reducing agents are employed. Tests indicated that if no sulfur-controlling agent were employed, sulfur contents as high as 0.25 pct could be expected. The addition of lime, limestone, or dolomite in powdered form did not lower the sulfur content sufficiently to permit use as melting stock.

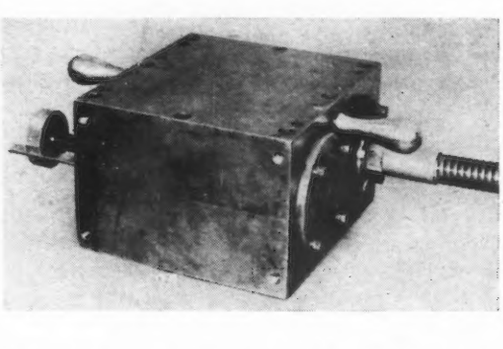
Recent experiments have indicated that when ore is reduced by coal or coke in the presence of powdered lime, almost all of the sulfur is contained in a basic slaglike coating on the particles rather than being distributed throughout the iron particles.

When sulfur-control agents such as sized dolomite are employed, which do not form a basic layer on the surface of the sponge iron particles, the sulfur is believed to be distributed through the sponge iron as sulfur in solution in the iron or as iron sulfide in the voids at sulfur contents above the solubility limit. Both lime and iron have an affinity for sulfur so the distribution of sulfur between these materials depends on the operating conditions.

Therefore it is necessary to have strongly reducing conditions present during the production of low-sulfur sponge iron, that is a high ratio of $CO:CO_2$. At temperatures of about 1472°F and above, a high ratio exists in equilibrium with charcoal and good desulfurization therefore occurs. Below those temperatures the ratio decreases rapidly and desulfurization is less effective. The proportion of sized dolomite used for the process is small and therefore does not add materially to the cost of the sponge iron.

Oscillator Permits Stepless Adjustment

AN OSCILLATOR weighing only 61 lb and which can be attached easily to a structure for inducing vibrations in dynamic testing is now available from Baldwin Locomotive Works, Philadelphia. This unit, shown in the accompanying illustration, is called the Sonntag LA-1 oscillator. The centrifugal force produced by eccentrically supported weights, rotated so that all forces add in one direction and cancel each other in all other directions, provides the vibration for the test.



The force is steplessly adjustable either while running or stationary by turning the micrometer type knob. The maximum allowable force of the machine itself is 1600 lb, but this is multiplied in resonance with the structure under test. The multiplication factor is determined by the damping of the structure. Factors as high as 200 have been encountered, making the machine in effect capable of producing loads of 1600 x 200, or 320,000 lb. The oscillator is provided with two types of drive, either a flexible shaft that will permit the motor to be mounted away from the oscillator, or with a V-belt drive for direct mounting. Also available as a standard accessory is a control cabinet and desk combination, mounted on casters, that provides space for reading instruments and controls as well as storage of the oscillator and accessories.

Improvised Carboloy Knurling Rolls Outlast Steel Knurls

A KNURLING operation performed at an Eastern aircraft plant on miscellaneous castings and forgings made from an extremely tough corrosion resistant steel, and also on parts made of high tensile steel stock having 180,000 psi or more, proved to be so severe that the high speed steel knurling rolls gave trouble regularly after knurling only 12 to 15 pieces.

In an effort to avoid continual replacement, the manufacturer made up two knurling rolls from Carboloy Grade 44A bushing stock, a grade of carbide combining great toughness with good wear resistance. A medium pitch serration was ground into the carbide rolls with a diamond wheel to form the knurls.

The carbide knurls have now been in continuous service for more than a year and are reported to be still in excellent condition. Knurling is performed dry in a Warner and Swasey turret lathe.

Automatic Welder Embodies New Principle

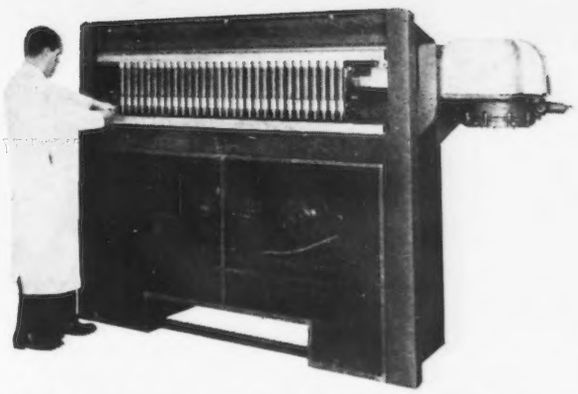


FIG. 1—The new Progress-O-Matic spotwelder which can accommodate as many as 60 guns, individually controlled and operated for varying metal thicknesses.

SAID to be even faster in operation than ultra-speed machines, a new development in automatic multi-spot resistance welding machines has been announced by Progressive Welder Co., 3050 E. Outer Drive, Detroit 12. These new units, embodying the Progress-O-Matic principle, may be classified as high-air-pressure operated and controlled automatic multiple spot welders.

In addition to high speed of operation, an outstanding advantage of these machines is that the various welding guns can weld different thicknesses of metal, requiring variable welding times, heats and speeds. Controlling the actuation of the individual spot welds by different guns is an air-driven Progress-O-Matic unit. This is an air driven unit for controlling the sequencing of the entire machine, including application of welding pressure to timing of welds, and controlling amount of welding current heat for each individual gun. Basic components of this unit are:

- A housing having sixty ports, one each for a possible maximum of sixty guns.
- A rotating disk which uncovers the various ports in sequence.
- A Geneva drive to this disk which creates a dwell of the disk at each port.
- An air motor which drives the disk through the Geneva drive.
- A drum direct connected to the disk. On this drum are 8 cams. Four of these control air flow to the air motor to vary air motor speeds. The other four cams operate switches to select the heat desired for each weld. Two breakers, synchronized with the indexing disk. Their function is to initiate and stop firing of the tube contactor.

As the rotating disk, indexing by virtue of the Geneva drive, uncovers the first port, high pressure air is admitted to the corresponding gun circuit, operating the circuit-closing cylinder on gun No. 1. At the same time the heat-control cams on the drum select the proper heat control for that gun, and the speed control cams adjust the speed of the air motor in accordance with the desired weld cycle for gun No. 1. The two breakers now close initiating the welding current to gun No. 1. At the proper instant, one of the breakers opens, interrupting the welding current.

The disk then indexes, closing port No. 1. The circuit-closing cylinder retracts, opening the circuit for that gun. The disk passes on at high speed to uncover port No. 2 and the same cycle is repeated for gun No. 2.

Reason for the use of multiple cams and breakers is to permit a wide range of adjustments. Thus the four speed-control cams control four air valves. These enable a wide speed variation of the air motor according to the length of dwell desired. Again, the four heat-control cams permit a broad selection, from 0 to 100 pct of heat, by means of transformer taps, or phase-shift heat control, if desired.

The breakers have 180° cams and rotate a total of 360° for each position of the disk. Use of two breakers, connected in series, permits full range of stepless adjustments for weld time.

Actual operation of the mechanism is extremely fast. The combination of the various features of the unit makes possible an extremely rapid cycling from gun to gun, together with accurate control for each gun to obtain the ideal welding conditions for that gun. It permits a combination of a wide variation of welds requiring both long or short welds without penalizing the complete machine cycle to accommodate the longest welds.

Current is supplied by a single water cooled transformer to all the guns. The electrical circuit is close-coupled so that there is very little reactance in the circuit and electrical efficiency is high.

Welding rates with this arrangement can be up to 50 pct higher than those possible with ultra-speed type or other automatic welders, it is reported. Another advantage is that the control unit can be located at any convenient position on or away from the machine.

The circuit for each gun is closed separately just before the welding current is applied, as previously mentioned. When it has completed its weld the circuit is again opened automatically. This arrangement also eliminates the need for sometimes troublesome flexible cables. Bus bar contactors are easily replaceable, if required.

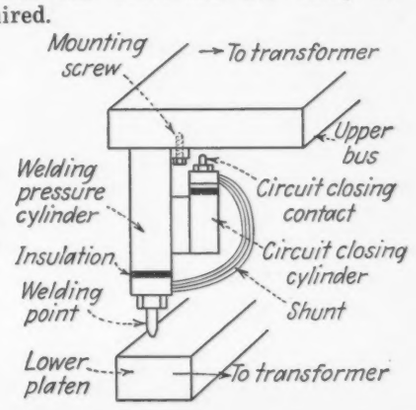


FIG. 2 — Sketch showing the manner in which each gun is mounted with a single screw.

Spot Testing For Aluminum

By W. E. THRUN and C. R. HEIDBRINK
Valparaiso University, Valparaiso, Ind.

IT IS necessary that the aluminum content, whether desirable or not, in scrap iron and steel be known so that proper procedure can be applied in steelmaking practice. To perform this analysis rapidly and also to distinguish between the various Alnico alloys of various aluminum contents, semiquantitative spot tests have been developed.

The reagent recommended for semiquantitative spot testing of aluminum in steel and iron is eriochromecyanine. It is not, however, too sensitive to the presence of iron, which may be present in small amounts in the ferric state. Phosphates in relatively large amounts do not interfere. It first was suggested as a reagent for aluminum by Eegriwe.[1]

The dye can be obtained in an impure form from the Hartman-Leddon Co., Philadelphia. It has a very high ash content and contains aluminum and a black substance giving a brown solution. The aluminum lake can be removed in a slightly alkaline solution by silica gel and the black substance by an activated black. To make a satisfactory solution dissolve 0.8 g of dye in 100 ml of water, add 8 drops of concentrated ammonia, 4.0 g of powdered silica gel ((8595-12) Davidson Chemical Corp., Baltimore) and 1.50 g of Darco. Shake moderately for 5 min, filter, and add two volumes of water before using for spot tests (keep in a pyrex flask). This final solution has the concentration of 0.1 pct of dye prepared according to U. S. patent No. 877052 and purified by fractional salting out and use of a black.

For articles on "Spot Test for Moly in Steel" and "Quick Methods for Identifying Metals" see THE IRON AGE, *Oct.* 3, 1946, *p.* 41 *and Oct.* 17, *p.* 58, *respectively.—Ed.*

Procedures—(1) Use standardized drops of 20 per ml (L) and 30 per ml (S). Mark off on clean metal a circle of about 1 cm diam (2.5 in.) with the edge of a piece of paraffin. Place a drop (L) conc. HCl and 2 drops (L) 6N nitric acid on the confined area. When action has ceased (about 2 min for steel, 1 min for iron), transfer a drop (S) of the solution to a spot plate depression. Now add 1 drop (L) 6N NaOH and 4 drops (S) 30 pct hydrogen peroxide and allow to react. Solution now must be alkaline. Transfer a drop (S) of the alkaline solution to a double thickness of S & S No. 589 filter paper. To the filtered spot add 2 drops (S) sodium acetate buffer solution (20 g $NaAc.3H_2O$ + 7 ml glacial HAc + 50 ml H_2O) and 1 drop (L) 0.1 pct eriochromecyanine. Note color, which turns bluish upon standing 5 min or longer. The time for 1 test is 4 min; for 7 tests, 20 min.

(2) To acid solution prepared as in (1) with HCl and nitric acid, add 3 drops (S) H_2O. Sprinkle a small amount of sodium peroxide on the solution, and after action has ceased, add 10 drops (S) H_2O and stir. Solution must be alkaline. Transfer 1 drop (S) to a double thickness of S & S No. 589 filter paper and procede as in (1). Time for 1 test is 3.5 min; for 7 tests, 16 min.

S & S No. 601 filter paper (special for spot tests) may be substituted for the No. 589, in which case a single thickness is used, the buffer solution and dye being added to the underside of the paper. This paper has the advantage of keeping spots small with even distribution of color, but it contains traces of iron and aluminum. If a blank test is made simultaneously,

[1] *Z. Anal. Chem.* 96, 91 (1929).

TABLE I

Results of Tests Conducted on Steels With Known Aluminum Content

Type Material	Pct Al	Spot Color Procedure (1)*	Spot Color Procedure (2)*
Type 306 steel	0.01	faint violet	very weak violet
Type 322 steel	0.21	weak violet	weak violet
Type 430 steel	none	pink of blank	pink of blank
Type 405 steel	0.30	moderate violet	moderate violet
SAE 1010 steel	none	pink of blank	pink of blank
Globeiron	trace	very faint violet	faint violet
Nitralloy "D"	1.06	very strong violet	very strong violet
Nitralloy "D"[1]	1.06	strong violet	strong violet
Nitralloy "D"[2]	1.06	moderate-strong violet	moderate-strong violet
Gray Iron	=	moderate violet	moderate violet

* These procedures are described in text. [1] Using 1 drop (S) HCl + 1 drop (S) HNO_3. [2] Using dilute spot solution, 1:1.

TABLE II

Dilution of Test Drop	Color Intensity of Spots (procedure (1)) Cast Iron, 2.4 pct Al	Alnico 5, 8.0 pct Al	Alnico 2, 10.0 pct Al	Alnico 1, 12.0 pct Al
Undil. 1 drop	very strong violet	very strong violet	deeper violet	deeper violet
Dil. 1 to 10	moderate violet	strong violet	very strong violet	very strong violet
Dil. 1 to 100	faint-weak violet	very weak violet	weak violet	weak-mod. violet
Dil. 1 to 1000	very faint violet	very faint violet	faint violet	very weak violet
Dil. 1 to 1200	color of blank	—	—	—
Dil. 1 to 1800	—	color of blank	—	—
Dil. 1 to 2000	—	—	color of blank	—
Dil. 1 to 2200	—	—	—	color of blank

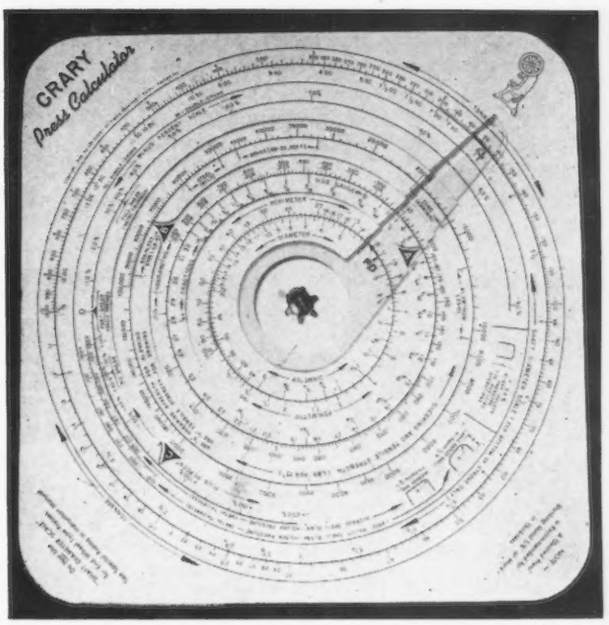
there is no difficulty in distinguishing various color intensities due to aluminum.

Results — The results of tests made on steels of known aluminum content are given in table I, showing that even traces of aluminum can be detected and that roughly quantitative results up to 0.30 pct can be obtained. For higher percentages, smaller amounts of acid or dilution before making the spot will give semiquantitative results. Attempts to simplify the test have failed so far.

Results on a 2.4 pct Al cast iron and on three Alnicos are given in table II. It is apparent that 2.4 pct Al cast iron and 8, 10, and 12 pct Alnico can be distinguished in two ways. The first method involves diluting the original acid solution drop successively, or at once, to 100 drops. The 1 to 100 dilutions give distinct differences in the color intensity of the spots. The second method consists of determining the dilution required to give a blank color, which is 1200, 1800, 2000, and 2200 respectively for the 2.4 pct Al cast iron and the 8, 10, and 12 pct Alnico.

Acknowledgment is due Alten's Foundry & Machine Works, Lancaster, Ohio, for a financial grant and to Martin D. Rosenthal of Globe Steel Tubes Co., Milwaukee, for the analyzed samples.

Slide Rule For Calculating Press Size



ALL of the necessarily involved calculations normally required to determine the proper size of press for blanking or drawing can now be eliminated by the use of an extremely simple slide-rule type of calculator recently perfected by engineers of the E. W. Bliss Co., Detroit. Known as the Crary calculator, it was conceived by Len Crary, staff engineer for the Bliss Co., and is available from the Calculator Co., P. O. Box 65, Teaneck, N. J.

As shown in the accompanying illustration, the device consists of a white plastic rectangle, three concentric disks, and a transparent straightedge. The various scales are engraved with slide rule accuracy and are covered with a plastic coating to prevent wear. Within 30 min, it is claimed, the average person can learn to figure any ordinary job. It is necessary only to set the appropriate dials to the known factors, and the tonnage of the press and the requisite shaft diameter are automatically computed and read directly from the outer scale.

For example, to calculate the tonnage of the press required for punching out a 6-in. diam blank from 0.05-in. mild steel with an ultimate shear strength of 50,000 psi, and using full shear on the die, the procedure would be as follows: Set the straightedge to the figure 6 on the inner circle, then rotate the inner disk, which will carry the straightedge with it, until the pointer A contacts 0.05 on the outer edge of the second disk, representing the metal thickness. The pointer B is then moved to point to 50,000 on the third disk, representing the shear strength of the material, and finally the pointer C is set according to the shear on the die. In the case under consideration the shear is equal to the metal thickness, and therefore the pointer is set to the right side of the O mark in the "minus percent scale" at 33 1/3 pct, representing full shear. Tonnage of the press required for the job is then read from the outer scale, and is found to be a little less than 16 tons. Immediately below the tonnage figure, a second figure is given representing the diameter of crankshaft capable of exerting a 16 ton pressure at the bottom of the stroke, in this case 2¼ in.

To further simplify the use of the calculator, the inner disk is graduated in diameters for round blanks, and in inches of perimeter for blanks of other shapes. The second or thickness disk is graduated in decimals of an inch, in fractions, and in USS Gage numbers, and the third disk shows the commonly used shear and tensile strengths for a variety of metals, to avoid the necessity of looking this up in tables.

For drawing operations, the calculations are equally simple, and full provision is made for the varying conditions that may be encountered. For drawing operations the press tonnage is given at a point away from the bottom of the stroke, and is read from the outer scale. Shaft diameter, however, is found from a scale on the back of the calculator, which takes into account the working stroke, and also indicates the maximum number of strokes per minute permissible.

Complete and nontechnical instructions are given in a manual which accompanies the instrument, and which covers all kinds of special cases. Specific working examples are used throughout, and all mathematical formulas are avoided. Included in this book are tables, never before published, giving tonnage capacity for various crankshaft diameters and working strokes, and maximum press speeds.

Strengthening Metal Parts by

WHEN a metal part is shot peened its surface is subjected to a shower of shot driven by an air blast or thrown against the surface from the vanes of a rapidly rotating wheel. The shot used is usually chilled cast iron, very hard, and the diameter of shot used ranges from 0.016 to 0.066 in. Each shot as it strikes the surface makes a slight indentation in the surface, causes a slight permanent stretching of the metal in the surface and at a short distance below the surface, and acts to strengthen the surface zone of metal by changing the shape and orientation of the crystalline grains so as more effectively to resist flow or fracture. Thus the metal in the surface zone is made somewhat stronger than the metal underneath this zone. Fig. 1 shows micrographs of sections of shot peened pieces of steel. The change of structure from the inner metal to the surface zone metal is marked, especially in the SAE 1020 steel, and shows one effect of the cold working under the shower of shot. Hardness tests of shot peened SAE 1020 steel show that the metal is hardened to a depth considerably greater than the depth to which changes of shape of crystalline grains can be detected in the micrograph.

But the change of shape and orientation of crystalline grains is not the only change caused by shot peening. As the individual pieces of shot strike the metal each one sets up localized stress-longitudinal, transverse and perpendicular compression at the surface, and at a slight distance below it. After the shot bounces off some residual stress remains in and near the surface—a longitudinal compressive stress, a transverse compressive stress, and probably a vertical compressive stress a little below the surface. The effect of the longitudinal and transverse compressive stresses are shown in fig. 2. The net result of this state of three-dimensional stress tends to offset any longitudinal tensile stress applied by a load or a bending moment. Then, since tensile stress of a given intensity has more tendency to cause the start of a fatigue crack than a compressive stress of the same intensity, this state of residual stress set up by shot peening, in general, increases the fatigue strength of a shot peened piece.

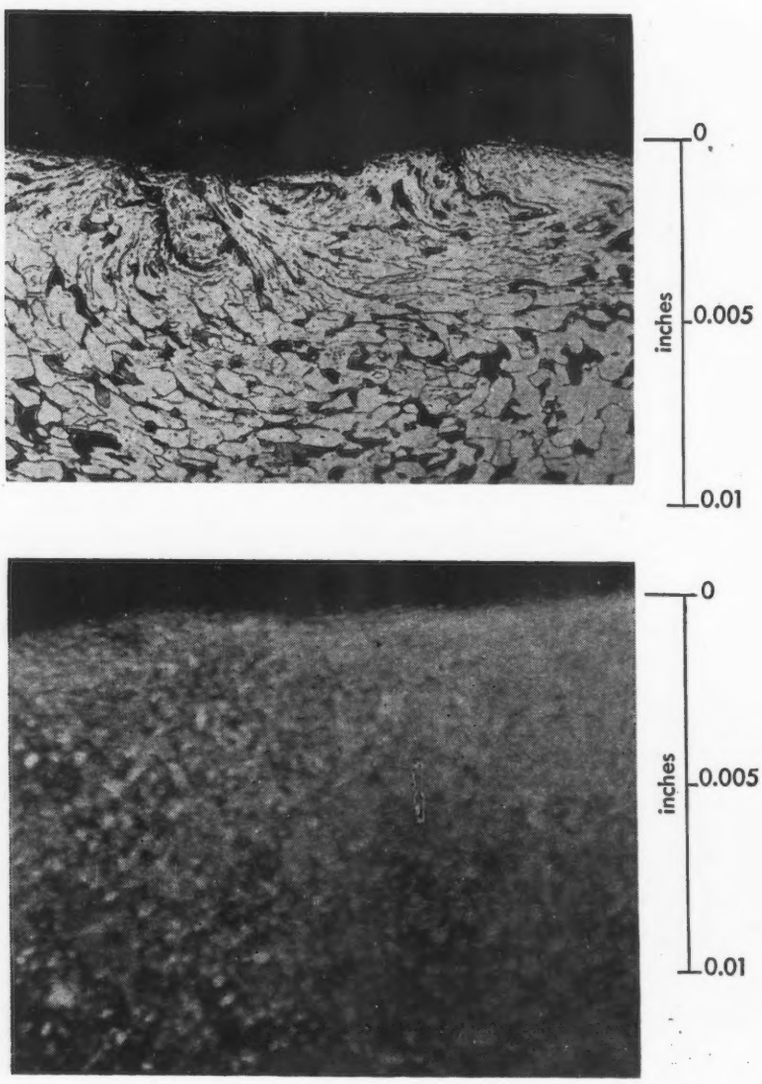


FIG. 1—Micrographs of longitudinal sections of shot peened steel. (Upper) SAE 1020 steel, shot peened. (Lower) SAE 1010 steel, carburized and then shot peened. X200.

There has been much discussion as to which of these two factors, increase of strength of metal by cold work or setting up of residual stresses which resist applied tensile stresses, is the more important, but whichever factor be considered the more important it is recognized that shot peening unless very poorly done, or carried to an excessive intensity, does cause an increase in the fatigue strength of a metal.

Shot peening does produce a great many shallow dents in the surface metal, dents with a smooth spherical surface, as shown in fig. 3. Moreover these dents are spaced very close together. The stress-intensifying influence of a very shallow dent is rather small, and the stress-intensifying influence of a number of stress raisers of any stype (dent, notch, hole, fillet, for example) spaced

by Shot Peening

By H. F. MOORE
Research Professor of Engineering Materials, Emeritus, University of Illinois and consultant on shot peening, American Foundry Equipment Co.

The phenomenon of metal fatigue and the effect of shot peening thereon are discussed. The author reviews factors leading to the development of fatigue fractures and proposes an explanation of the function of shot peening in strengthening metals. Results of numerous fatigue tests of peened and unpeened metal are tabulated and corresponding S-N diagrams are given. The article, based on research conducted by the author as consultant for the American Foundry Equipment Co., supplements an earlier report published in THE IRON AGE, Nov. 2, 1944, p. 67.

close together is less than that of a single stress raiser.[1] Closely spaced stress raisers seem to some extent to share the intensified stress among themselves, instead of leaving the whole intensification of stress to be carried by one stress raiser. At any rate the stress-raising effect of the peened surface of metal seems to be quite small.

[1] *Moore, R. R., "Effect of Grooves, Threads and Corrosion upon the Fatigue of Metals,"* Proceedings, ASTM, *Vol. 26, part II, p.* 255 (1926).

In the foregoing paragraphs the terms "failure" of metal parts and "strength" of the material have been freely used. When due to load or bending moment or twisting moments a structural or machine part ceases to function properly it has received "structural damage." At this point it may be worth while to consider various kinds of structural damage.

(1) *Excessive Elastic Deformation*—If the spindle of a milling machine is too light for a given piece of work, it will deflect. Then the cutter will not cut a slot with the bottom parallel with the top surface of the piece. This is no failure of the material, but the spindle has not elastic stiffness to function satisfactorily. Shot peening would be of no service in such a case; it would not appreciably change the elastic stiffness of the steel and the only remedy is a larger spindle, or a lighter cut.

(2) *Elastic Buckling*—This is another case of failure, or at least the beginning of failure, which takes place within the elastic range of the metal. A long, slender column when compressed lengthwise will begin to buckle before the metal is stressed beyond its elastic range. Here, too, shot peening will be of very little aid. The critical load which will start elastic buckling will depend, not on strength, but on stiffness of the metal which will be very little changed by shot peening in the case of iron and steel, and not greatly changed for most other structural metals. Note again that the reference here is to elastic buckling, not about buckling after the metal has passed beyond the range of elastic strength into the range where the deformation is partly plastic.

(3) *Plastic Deformation*—Deformation of a machine part which remains as set after load is removed is in itself structural damage in such parts as bolt and nut connections, which become loose when they are loaded beyond the elastic range of the metal. In short and in medium-length columns plastic deformation reduces the stiffness of the metal very greatly, and buckling follows, leading to the collapse of the column. In statically loaded structural members failure by plastic bending under compressive stress (exceeding the yield strength in compression) is probably the most common type of structural damage due to stress. Shot peening may be used to increase the resistance to plastic yielding of sheet metal and thin plate metal parts.

(4) *Creep*—Damage by creep is similar in character to damage by plastic deformation, but creep continues, while simple plastic distortion does not increase after a few moments of load, or at any rate such increase is negligible. For the common structural metals creep is important only at elevated temperatures. Very little is known about the effect of shot peening on creep.

(5) *Fracture*—Fracture takes place in locations under tensile stress or shearing stress. While plastic deformation and creep are phenomena involving appreciable volumes of metal before appreciable structural damage is done, fracture may start at some point of localized stress concentration, such as a sharp shoulder on a shaft, and from a nucleus a crack may spread to fracture of the piece. In the case of a brittle metal, fracture may start at such a point under

FIG. 2—SAE 1020 steel shot peened on one side. The double curvature of the piece after shot peening indicates residual compressive stresses in two directions at right angles. Probably vertical residual stresses also exist in the piece.

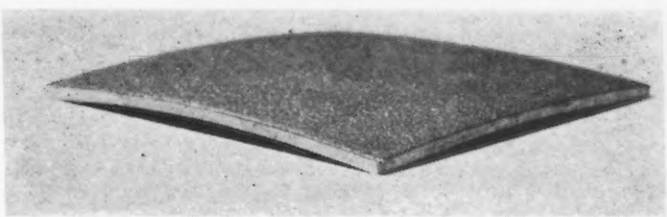


TABLE I

Comparison of Length of Life and Fatigue Strength of a Ni-Cr-Mo Steel Heat Treated and Carburized and Given Different Surface Treatments

(Fatigue tests were made under cycles of reversed bending stress)

A. Comparison Based on Length of Life for a Given Stress							
Applied Stress, psi	90,000	85,000	80,000	75,000	70,000	65,000	60,000
Cycles of Stress for Fracture:							
Surface left as Carburized	19,000	35,000	55,000	80,000	130,000	200,000	420,000
Surface Polished	14,000	38,000	85,000	210,000	500,000	Indefinitely large	
Surface Shot Peened	14,000	48,000	190,000	600,000	Indefinitely large		
Increase of Length of Life (number of cycles of stress for fracture):							
(1) Of peened steel over steel with surface as carburized, pct	−35	+37	+246	+650	Indefinitely large		
(2) Of peened steel over steel polished but not peened, pct	−35	+26	+125	+186	Indefinitely large		
B. Comparison Based on Applied Stress for a Given Length of Life							
Cycles of Stress for Fracture			50,000	100,000	500,000	1,000,000	10,000,000
Applied Stress, psi:							
Surface left as Carburized			81,000	73,000	59,000	58,500	58,000
Surface Polished			83,000	79,000	70,000	68,500	68,500
Surface Shot Peened			85,000	82,500	77,000	73,500	71,500
Increase of Fatigue Strength:							
(1) Of peened steel over steel with surface as carburized, pct			+5	+13	+30	+25	+23
(2) Of peened steel over steel polished but not peened, pct			+2	+4	+10	+8	+4

steady load; for ductile metals appreciable yielding takes place under a steady load, and this yielding evens up the stress distribution, cutting down the high peaks of stress, with localized plastic deformation rather than fracture. Frequently such localized plastic deformation produces no appreciable structural damage to the part as a whole.

However, under many cycles of repeated stress, especially cycles of reversed stress, a crack may start in the minute area of plastically deformed metal. This crack is due to the exhaustion of the ductility of the over-stressed metal, and the crack, once started, will spread, even under a relatively low stress, causing final fracture without appreciable elongation or shortening of the piece fractured. This process of fracture of metals under repeated stress has been given the rather inappropriate name of "fatigue of metals."

Such a spreading crack (fatigue crack) usually starts in a region of high shearing stress within one or more of the crystalline grains which make up a

TABLE II

Comparison of Length of Life and of Fatigue Strength of SAE 1020 Plain Carbon Steel Hot Rolled and Given Different Surface Treatments

(Fatigue tests were made under cycles of reversed bending stress)

A. Comparison Based on Length of Life for a Given Stress						
Applied Stress, psi	55,000	50,000	45,000	40,000	35,000	30,000
Cycles of Stress for Fracture:						
Surface left as Hot-Rolled	17,000	22,000	32,000	55,000	200,000	700,000
Surface Polished	25,000	44,000	110,000	280,000	4,000,000	Indef. large
Surface Peened	28,000	60,000	185,000	850,000	Indefinitely large	
Increase in Length of Life (number of cycles of stress for fracture):						
(1) Of peened steel over steel with surface left as hot rolled, pct	+64	+172	+478	+1440	Indefinitely large	
(2) Of peened steel over steel polished but not peened, pct	+12	+36	+68	+204	Indefinitely large	
B. Comparison Based on Applied Stress for a Given Length of Life						
Cycles of Stress for Fracture	50,000	100,000	500,000	1,000,000	10,000,000	
Applied Stress, psi:						
Surface left as Hot-Rolled	41,000	38,000	31,500	29,500	28,600	
Surface Polished	48,500	45,500	38,000	36,500	34,500	
Surface Shot Peened	51,000	47,500	41,500	39,600	37,500	
Increase in Fatigue Strength:						
(1) Of peened steel over steel with surface left as hot-rolled, pct	+24	+25	+32	+34	+34	
(2) Of peened steel over steel polished but not peened, pct	+5	+4	+9	+8	+9	

piece of metal. However, as the crack spreads in a region of tensile stress, it soon takes up a direction at right angles to the principal tensile stress. In a region of compressive stress the crack at first frequently follows a direction of maximum shearing stress, and the crack progresses much more slowly than it does in a region of tensile stress. In structural metals increase of tensile stress or of compressive stress is accompanied by increase of shearing stress, and so any process which increases tensile strength usually increases resistance to "fatigue," although not necessarily proportionately.

In machine parts, and especially in airplane parts, fracture under cycles of repeated stress is public enemy No. 1, and hence the greater part of this article is given to a discussion of fatigue failure and the effect of shot peening on the fatigue of metals. However, the failure of shot peened and of unpeened specimens of structural steel by permanent deformation and plastic yielding is discussed in later paragraphs.

Fig. 4 shows typical S-N diagrams for specimens of SAE 1020 plain carbon steel and specimens of a Ni-Cr-Mo steel heat treated and then carburized. Different sets of specimens of each steel were given different surface treatments as indicated. A glance at the figure shows that the S-N diagrams have all flattened out so that at 10,000,000 cycles of stress they are nearly horizontal. It is possible, then, without danger of seriously overestimating fatigue strength, to consider the stresses withstood for 10,000,000 cycles as the endurance limit (fatigue strength) for an indefinitely large number of cycles of stress. It will be noted that shot peening increased the fatigue strength of both metals above that of unpeened steel, and appreciably above that of steel unpeened but polished. The slight improvement in the fatigue strength of the alloy steel by honing the surface after shot peening is of interest.

It will also be noted that for cases in which fracture occurred under high stress and after relatively few cycles of stress that the difference between fatigue strengths for different surface treatments was smaller than the difference between fatigue strength for large numbers of cycles of stress. At 10,000 cycles of stress the fatigue strength of alloy steel seemed to be about the same, whether the surface was as received, honed, polished, shot peened or shot peened and then honed. For the SAE 1020 steel the same tendency can be seen, although not so strikingly as for the alloy steel.

A quantitative estimate of the percentage of improvement in resistance to fatigue fracture for shot peened metal over that of unpeened metal may be made on either of two basis:

(1) A comparison of the number of cycles of stress necessary to cause fracture under a given applied stress.

(2) A comparison of the applied stresses required to cause frac-

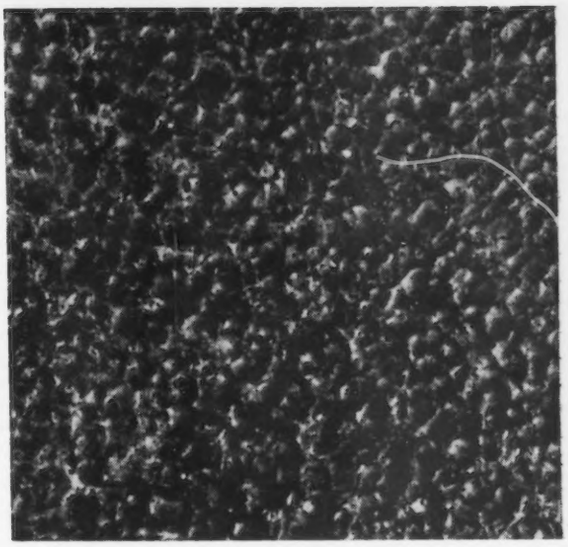


FIG. 3—Surface of shot peened steel. SAE 1030 steel, carburized and heat treated to a hardness of Rc 62. Shot peened using American Foundry Equipment Co. new No. P-55 shot. Intensity of peening was to an arc height of 0.010 in. on an Almen type C test strip. X7. Photo by C. W. Dollins.

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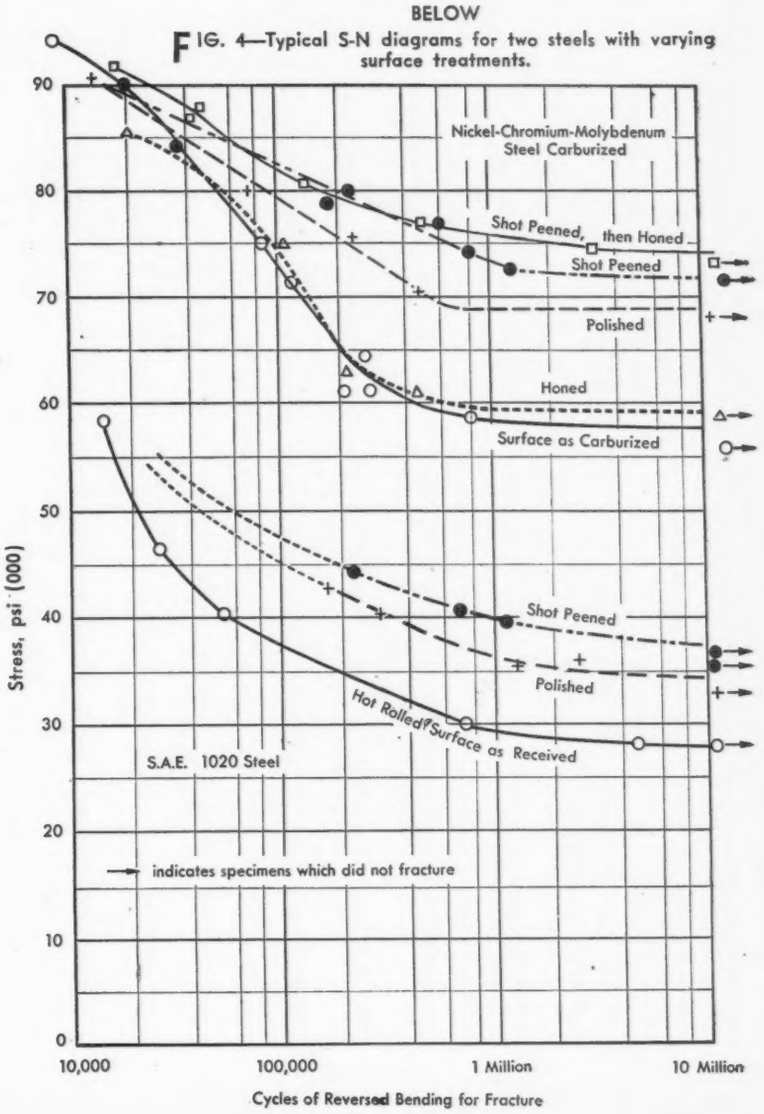
BELOW

FIG. 4—Typical S-N diagrams for two steels with varying surface treatments.



ture after a given number of cycles of stress.

Table I(A) shows the comparison on basis (1) for the alloy steel whose S-N diagrams are shown in fig. 4, and table I (B) shows the comparison on basis (2) for that steel. Tables II (A) and II (B) show the comparisons for the SAE 1020 steel.

It will be noted that in the tests whose results are shown in tables I (A) and II (A), as the applied stress decreases the percentage gain in length of endurance (life) for peened steel over unpeened steel increases, and that for length of life somewhere between 1,000,000 and 10,000,000 cycles the S-N diagrams become very nearly horizontal, so that quantitative comparison of length of life becomes impossible. Considering Tables I(B) and II(B) it is seen comparison can be made on basis (2) up to the largest number of cycles of stress used in a series of tests—10,000,000 in this case.

The applied stress at which the S-N diagram for a metal becomes horizontal is called the endurance limit for indefinitely long life or more commonly, simply the endurance limit. On account of the impossibility of comparing length of life of two metals for applied stresses below the endurance limit of either one of them, the comparison of stresses for a given life is to be preferred to the comparison of life for a given applied stress. There are, however, many cases in which length of endurance for satisfactory service is a more convenient basis for evaluating resistance to fatigue than is applied stress (or load, which is assumed to be proportional to applied stress). An examination of the S-N diagrams shown in fig. 4 shows that a small percentage increase of stress causes a relatively large decrease in length of service before fracture. Examination of many hundreds of S-N diagrams confirms this statement, and also shows that there is a considerable amount of scatter of results even in carefully conducted fatigue tests. This means that whether applied stress or length of life before probable fracture is used as the basis of computation by the designer of machine parts, a factor of safety must be used.

If it is desired to design a machine part on the basis of a satisfactory length of service before fracture the designer should use for his computation a life many times (from 10 to 20 times) the desired length of satisfactory service. On the other hand, if the applied stress for the desired length of satisfactory service is used, the reduction factor for that applied stress, based on the endurance limit for a satisfactory life, after allowance has been made for stress raisers, residual stresses, size of part, range of applied stress during a cycle, size of piece and any other factors which may be judged to affect fatigue strength—this reduction factor then may be much smaller (from 1.5 to 3).

Comparisons of length of life under a single given cycle of repeated stress cannot be made on a percentage basis alone since the percentage of gain of life due to peening increases rapidly as the magnitude of stress is decreased. Moreover, this percentage cannot be computed for stresses below the endurance limit of the unpeened metal. Values of percentage increase in life in actual service have been reported for springs and automobile parts, and the increase of life due to shot peening ranges from 3 to 20 times.

It is equally true that comparisons of fatigue strength cannot be made on the basis of applied stress for only one length of life, since many structural and machine parts are designed to withstand only a limited number of cycles of stress. For a satisfactory comparison of the relative fatigue strengths of two

TABLE III

Effect of Shot Peening on the Fatigue Strength of Steel

Metal	Stress Cycle	Surface Condition as Received	Endurance Limit for 10,000,000 Cycles Of Stress, Psi			Gained by Shot Peening, Pct		
			As Received	Polished	Shot Peened*	Over "As Rec'd"	Over Polished	Reference
Nonferrous Metals								
Duralumin (315.5)	Reversed Bending	Fine Turned	17,000		19,900	16		6
Magnesium Alloy (Elektron AZ 31)	Reversed Bending	Fine Turned	13,500		17,100	26		6
Elektron Casting	Reversed Bending	Fine Turned	7,100		8,800	24		6
Phosphor Bronze Wire	Torsion, 20,000 psi to Max.	As Drawn	35,000		50,000	43		7
Phosphor Bronze Sheet	Reversed Bending	As Rolled	31,600		47,900	54		8
Steels, Including Stainless Steels								
SAE 1020	Reversed Bending	As Rolled	28,000	34,500	37,500	34	9	8
SAE 1045, induction hardened	Reversed Bending	As after Hardening	50,000		75,000	50		8
SAE 1045, normalized and tempered	Reversed Bending	As Rolled		31,000	34,000		11	9
SAE 1050 Plate	Reversed Bending	As Rolled		37,000	47,000		27	8
Steel from R R. Rail	Max. Compression to 20 pct Tension	As Rolled	59,000		78,000	32		11
0.85 pct C, Spring Wire	Torsion, 20,000 psi to Max.	As Drawn	95,000		135,000	42		7
SAE 1095 Music Wire	Torsion, 20,000 psi to Max.	As Drawn	90,000		135,000	50		7
SAE X4340 Oil Quenched and Drawn	Reversed Bending	As Rolled		66,500	78,000		18	10
Ni-Cr-Mo, Carburized and Heat Treated	Reversed Bending	As Heat Treated	58,000	68,500	71,500	23	4	8
NE 9470, Carburized	Reversed Bending	As Carburized	100,000		150,000	50		8
NE 9420, Carburized	Reversed Bending	As Carburized	100,000		153,000	53		8
High Strength Alloy	Reversed Bending	Roughened with No. 24 Emery Cloth	66,400	79,500	81,800	23	2	6
18-8 Stainless Wire	Torsion, 20,000 psi to Max.	As Drawn	65,000		110,000	69		7
18-8 Stainless Bar	Torsion, zero to Max.	As Rolled	46,000		92,000	100		12
13-2 Stainless Wire	Torsion, 20,000 psi to Max.	As Drawn	80,000		120,000	50		7

*Not polished before shot peening.

metals, of peened and unpeened metals, or of machine parts made of different metals, an S-N or a Load-N diagram should be available up to several times the number of cycles to be expected in a satisfactory length of service for the part. This is true whether the comparison of fatigue-resisting value is made on the basis of an applied stress for a given life or on life for a given applied stress.

Table III summarizes a number of published results of fatigue tests of various metals. Some of the tests were made on specimens polished, but not shot peened, other tests were made on specimens shot peened but not polished, either before or after shot peening while still other tests were made on specimens with surface as received. The table is based on the applied stress which is required to make fracture imminent at 10,000,000 cycles of stress. For most, if not all, of the steels this stress may be regarded as the endurance limit for an indefinitely long length of life, measured in cycles of stress; however for the nonferrous metals listed in table III the value of applied stress for fracture after 10,000,000 cycles of stress is probably distinctly higher than the value of applied stress for an "indefinitely large" number of cycles of stress, if, indeed any such absolute endurance limit can be found for certain nonferrous metals.

From some of the test results listed in table III a comparison can be made of the fatigue strength of the shot peened specimens with that of the corresponding specimens unpeened but polished. Polished in this article means polishing with No. 00 emery cloth, or finer. Naturally the percentage gains shown in such a comparison are less than the corresponding percentage gains of fatigue strength of shot peened specimens over fatigue strength of specimens with surfaces left as rolled, as heat treated, or as carburized. Examining the test results for the six series of tests in which unpeened but polished specimens were tested (see the fifth column of table III) it is seen that in all six cases the fatigue strength of the shot peened specimens was greater than that of the specimens which were polished but unpeened. The percentage gain in fatigue strength ranged from 2 pct for a high strength alloy steel tested by Wiegand to 27 pct for specimens of SAE 1050 steel plate.

It will be noted that for test results for specimens for which the comparison is between strength of specimens shot peened with strength as received, the fatigue strength of the shot peened specimens ranged from 16 to 100 pct higher than that of the as received specimens. The highest two percentage gains, 100 and 69 pct, were both for 18-8 stainless. For the other test results the percentage of gain for peened specimens over specimens neither peened nor polished showed no systematic variation for different metals tested. The rather wide scatter of results suggested that variations in the technique of shot peening may have a large influence in the fatigue strength of the peened metal.

Size Effect in Shot Peened Parts

Wahl[2] shows values for small diameter shot peened steel spring specimens some 20 pct greater than the values for "large diameter" shot peened steel spring specimens of the same metal. Presumably the intensity of peening was the same in the two cases. Wahl's tests showed that for his test specimens there was an appreciable size effect. Some fatigue tests at the research laboratories of General Motors show track pins 1¼ in. diam all tested under the same range of stress

[2] *Wahl, A. M., "Spring Materials," Machine Design. October 1940, p. 46. Note especially graphs of fatigue strength in Fig. 1.*

developed an increase of life of about two times when the intensity of peening was increased from that which gave an arc height of 0.004 on an Almen C-1 gage to one which gave an arc height of 0.015 on the same gage. That is, increase of intensity of peening appreciably lengthened the life of these 1¼ in. pins on a rather short-time test. The effect of increased intensity of peening on the depth of peening and on the short-time and the long-time fatigue strength of specimens up to 2 in. or more in diameter is a field for fruitful study and experiment. Cold-rolling, cold-drawing, polishing, some types of machining, and the action of cycles of repeated stress tend to produce a hardened surface zone like that produced by shot peening. The depth of this hardened zone may vary from a few thousandths of an inch by light polishing to, perhaps, several tenths of an inch by cold rolling.

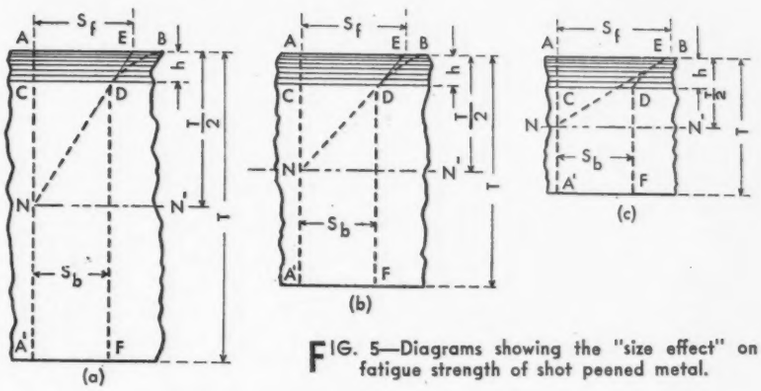


FIG. 5—Diagrams showing the "size effect" on fatigue strength of shot peened metal.

Fig. 5 is a diagram showing the effect of shot peening on the strength of pieces of different thicknesses. The figure shows what is probably an over-simplified picture of the state of stress, and of resistance to it. It is given as a cartoon, rather than as a scale drawing for quantitative measurements. In Fig. 5 are shown pieces of three bars of the same metal but of different thickness. All are supposed to have been shot peened to the same intensity of peening, and there has been produced a surface layer of shot peened and hardened metal, *A B D C* with a depth *h*. Judged by hardness studies *h* may be two or three hundredths of an inch for structural steel. The metal in this layer will be stronger than that below *CD* and the strength at the surface will be greater than that below the surface, varying from *AB* to *CD* along the curve *BD*. In drawing this diagram hardness determinations (Vickers-Brinell) were made at different depths below the shot peened surface of structural steel, and the fatigue strength was assumed to be proportional to the hardness. This is probably a fair assumption for structural steel. Below *CD* the strength is constant and is equal to *CD*, which may be designated by *Sb*, which represents the strength of the metal unaffected by shot peening. Now suppose bending moment to be applied to the piece. The neutral axis of

the piece is *NN'*, and the applied stress setup will, up to yielding of the metal, be proportional to the distance from *NN'*, that is, will at any point be measured by the horizontal distance from *NC* to *NA*. If this stress reaches the magnitude *CD* in the unpeened metal, the magnitude *AB* at the surface, or the magnitude represented by the horizontal distance from *AC* to *DE* for any depth within the peened zone, then structural damage will be done to the metal. The stress at the surface, which is the stress computed by the ordinary flexure formula, will then be *AE*, and may be designated by the symbol *Sf*. In the thickest piece (a) damage will have been done to the unpeened metal along *CD*, and the computed stress *Sf* is equal to *AE*. In the piece (b) the first damage is done to the unpeened metal along *CD*, and the computed stress *Sf* is somewhat larger than *Sf* for piece (a). In the thinnest piece (c) the first damage is done when the surface stress reaches the strength of the peened metal at the surface, and the value of *Sf* is still larger. However for pieces thinner than (c) the value of *Sf* would remain constant at the strength of the peened metal of the surface, *AB*. Evidently for thicker pieces than those shown the value of *Sf* would diminish, approaching the value *CD* for a piece of infinite thickness as the length *AE* approached the limit *CD*.

It is to be noted that in the foregoing study of size effect the same intensity of peening is assumed for different sizes of the peened article. If increased intensity of peening can increase the depth of the peened surface zone (*h* in fig. 5) the strength of the peened article will be increased up to the point of overpeening.

The author will conclude this discussion of metal fatigue and shot peening in the next issue.—Ed.

German Bimetal Tubing

A PROCESS for producing steel tubing with copper or bronze plating or cladding (both inside or outside) at the Osnabrucker Kupfer u. Drahtwerk plant at Osnabruck, Germany, is described by Sam Tour, Tour & Co., Inc., New York, in a Joint Intelligence Objectives Agency report. When producing tubing with inside plating, the raw material consists of steel with less than 0.12 pct C and colddrawn copper tubes. The smallest steel tube to start with is about 1.57 x 1.18 in. for the following reasons: The plating procedure, including the expenses for cleaning, is an important part of the cost—the greater the surface, the higher the cost. The cost drops, therefore, as the wall thickness of the steel tube increases. The plating material must be kept within the ratio of 10 to 30 pct of the wall thickness. With smaller wall thickness of the steel tube the copper tube to be inserted would be so thin as to raise the cost price as well as endanger the safety of the plating.

The surfaces to be bonded together are cleaned by means of sand blasting and the tubes are drawn cold one upon the other, steel outside, copper inside. The assembly is then heated to bonding temperature, approximately 1830°F, and bonding results from the greater heat expansion of the copper tube inside the steel tube. Finishing is by cold drawing of the tube down to finished dimensions; intermediate anneals are used after every 3 or 4 drawings. In some cases the surface of the tubes to be drawn are bonderized.

In the production of tubing with outside plating, the raw materials are the same as that used for inside plating; cleaning of the surfaces is identical for 60th outside and inside plating. The tubes are then drawn cold, one upon the other, steel inside and copper outside. Heating of the tubing is the same as for inside plating, but is followed by a hot drawing at plating temperature. Finishing is by cold drawing.

For outside and inside plating the outside plating must be performed first. If the inner copper tube is drawn in first it is damaged by the hot drawing necessary for the outside plating. After the hot draw for the outside plating the inside is cleaned and practice follows that outlined previously. The final assembly is then finished by cold drawing, also as described for inside plating.

It is evident that the process for producing an inner lining of copper in a steel tube depends upon the basic principle that copper has a higher coefficient of expansion than steel and that at temperatures of 1650° to 1830°F, in the absence of oxidizing conditions, copper or bronze will alloy with steel or become fully bonded to steel as the result of the application of fairly low pressures. For outside cladding of steel with copper alloys, it is evident that the higher coefficient of expansion of nonferrous alloys results in an expansion away from the steel, so that the pressure required for bonding or alloying must be obtained by a drawing operation at temperature.

The report states that the requirement for steel tubing have a carbon content on the order of under 0.12 pct C came from the fact that carbon in steel reduces the diffusion rates of copper in steel and prevents alloying or bonding at the surface. It was stated that steels of carbon content of 0.15 pct and under are usable, but at around 0.16 pct C, bonding becomes difficult and at 0.20 pct bonding is practically impossible.

It was reported that this copper covered steel tubing was produced largely of a composite containing approximately 20 pct of cladding metal but there had been some production with as low as 5 to 10 pct. The final product was drawn down by cold-drawing methods to as small as 0.118 in. diam, although it was admitted that at this small size the product was much more expensive than solid copper tubing. In the cold-drawing sequence, anneals were applied after every two or three draws, with annealing temperatures of 1290°F used. Heating for annealing was carried out in gas-fired furnaces with sooty atmospheres (a statement was made that the soot facilitated drawing).

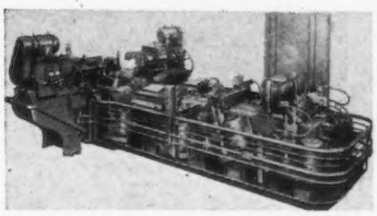
It was further stated that this cladding operation was not carried out with brass or copper alloys containing any considerable quantities of zinc. The explanation for this was that the zinc vaporized too rapidly and a zinc-iron compound formed between the steel and the copper alloy and interfered with the bonding process. Commercial bronze containing 90 pct Cu and 10 pct Zn had not been tried. Aluminum brass, containing 76 pct Cu, 22 pct Zn and 2 pct Al had been tried but was found to be unsatisfactory. A high copper bronze containing 96 pct Cu, 2 pct Zn and 2 pct Sn was reported to have been used in considerable quantities as the inner lining of this bimetal tube for final application in brake cylinders.

New Equipment . . .

Machine Tools

Various types of drilling machines, vertical and special purpose boring units, center type, form, cutter and tool grinders and tapping units are reviewed in this week's issue. A rod balancing machine, metal saw, coil winder, chip separator and feeding hopper are several of the other tools discussed.

ANNOUNCEMENT of a machine for drilling a series of holes for mounting bodies, motors and spring suspensions in automobile frames has been made by the *Snyder Tool & Engineering Co.*, 3400 E. Lafayette, Detroit 7. This machine accommodates three different size frames, adjustment to longer or shorter frames being made by



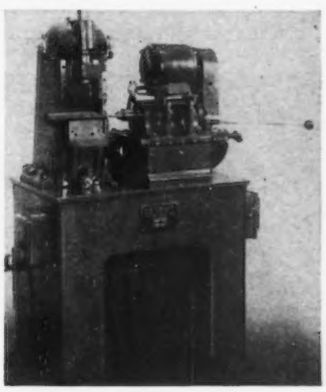
moving the entire clamping bracket as well as the spindles, and positioning in correct location for the individual frame. Frames are located on equalizing clamps and are positioned and clamped by means of air cylinders and cam clamps. The series of vertical and angular spindles are driven from individual motors and are fed through the work by one hydraulic cylinder which actuates action pinions. The design of the machine provides piping for coolant, air and electric wiring on the outside.

Multiple Driller

DESIGNED as a unit of a production line, a multiple driller CCDHSI announced by the *B. M. Root Co.*, York, Pa., drills rows of holes in strips of sheet metal, tubes, and extruded or fabricated shapes. The maximum distance between the columns is 8 ft 6½ in.; maximum boring length or distance between outside spindles is 8 ft. The machine is equipped with 22 style D11 ball bearing spindles for 2⅜-in. min boring centers. However, any style D spindles may be used in combination. Feed rate is from 2 to 35 table strokes per min; adjustable feed stroke length is ½ to 16 in. The distance between spindle nose and the table, in lowest position, is 18 in.

Center Drilling Machine

SAID to require a minimum of skill to operate, a center drilling machine with automatic centering and clamping has been produced by the *Detroit Tap & Tool Co.*, 8432 Butler Ave., Detroit 11. A single lever controls all operations, including automatic positioning clamping, and feeding the drill. Concentric centers may be drilled in round or square stock ranging from ⅛ to 2⅜ in. OD. Length of stock is limited only by convenience in handling. The self-centering vise automatically clamps the work in concentric alignment



with the centering drill. The drill has three speeds: 1250, 2400, or 5200 rpm, obtained through a V belt pulley drive from the spindle drive motor. The spindle chuck has a center drill capacity form ⅛ to ½-in. OD.

Boring Marhine

BORING, facing and chamfering and counter boring are accomplished on electric motor frames in one setup with the 2W Way type two head boring machine developed by the *Davis & Thompson Co.*, 6411 W. Burnham St., Milwaukee 14. Hydraulic power, electrically or manually controlled actuates the feed cycle of the machine. Two 15 hp dc, variable speed motors, one on each head, operate the spindles. Spindle speeds are variable from

80 to 320 rpm. One 10-hp motor operating at 1200 rpm operates the two Vickers pumps supplying power to the hydraulic system. Feed is operated hydraulically through a two speed gear box, ranging from ¼ to 7 ipm, rapid traverse and return being at the rate of 200 ipm. Cutter spindles are 12 in. in diam and are taper bearing mounted. Tungsten carbide tools are used.

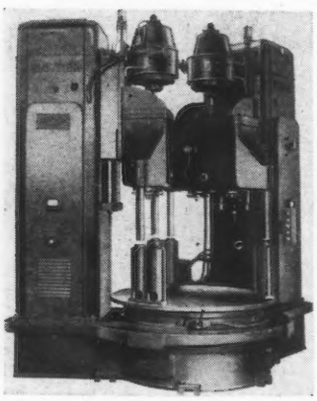
Vertical Boring Machine

FOR precision rough and finish boring of large cylinders up to 40 in. in length and 6 to 8 in. diam, a vertical boring machine has been announced by *Giern & Anholtt Tool Co.*, 1314 Mt. Elliott Ave., Detroit 7. The machine, identified as the TR model, is said to offer extreme rigidity and accuracy with the spindle piloted directly above the work in a Gatco sealed rotary bushing. It is equipped to bore cast iron, steel or nonferrous tubes using a multiple blade boring cutter. Model TR is hydraulically operated and has a feed on 8-in. ID tubing of 4 ipm in roughing and 4½ to 5 in. in finishing. The power requirement on the operation is approxi-

mately 10 hp. Coolant provisions are incorporated with the direct flow of the coolant over the cutter for the entire depth of the cut.

Special-Purpose Boring Machine

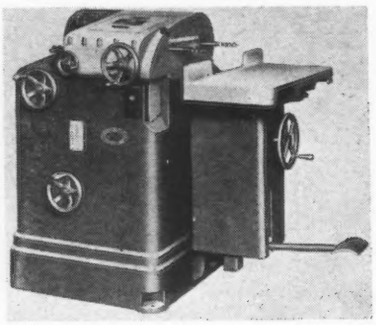
FOR rough and finish boring of compressor casings and cylinders, a special-purpose machine has been designed by *Snyder Tool & Engineering Co.*, 3400 E. Lafayette, Detroit 7. While primarily intended for dry work on cast iron, provision is made in the base for the use of coolant if that necessity should develop. The machine consists, essentially, of a special welded steel base upon which are mounted two hydraulic column and platen assemblies and a manually operated index table. Each of the two-spindle boring heads is driven from an individual



variable-speed dc motor and each boring spindle is equipped with special clamps to permit boring bars to be exchanged quickly, thus providing adaptability to a wide range of work sizes in diameter as well as in length. Spindle speed is controlled by rheostat to the dc motors and is shown on an indicator.

Two-Spindle Borer

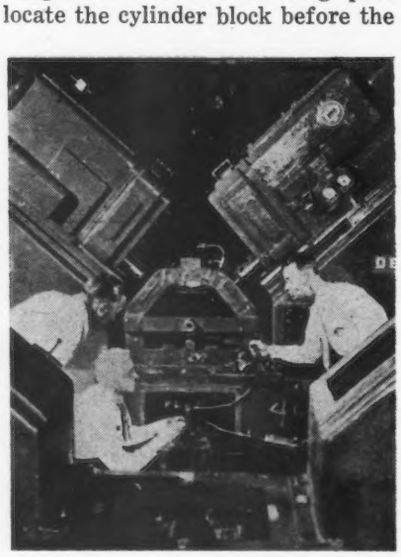
DESIGNED to meet the needs of plastic, light metal and allied industries, a two-spindle radial borer has been produced by the *Moak Machine & Tool Co.*, Port Huron, Mich., featuring an enclosed aluminum top which permits movement of the head to any position in a 90° arc and adjustment of the spindles from 1 1/16 to 12 in. apart. The right hand spindle is stationary, left hand spindle adjustable, and their speed can be varied from 1000 to 4000 rpm, insuring production efficiency regardless of the size of the hole. A new type of foot treadle has an arrangement in which a quadrant allows cables to move the table in a straight line. Position or adjustment of the treadle is not changed by raising or lowering the table. Spindles are driven by a silent



chain and the opening through which the movable spindle travels is completely enclosed.

Valve Hole Machine

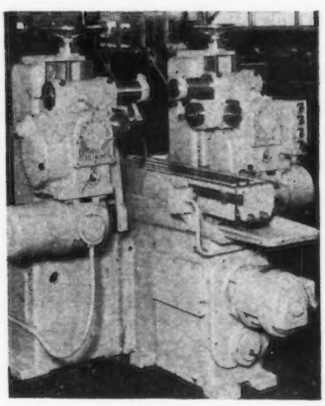
A SERIES of eight machines has been designed by *Defiance Machine Works, Inc.*, Defiance, Ohio, for production machining of valve holes and inserts in the manufacture of V type motors. These machines, which are No. 37 hydraulic units, are mounted in pairs on columns with the proper angle for machining the valve holes. The series of machines uses tunnel type fixtures. Locating pins and clamping arrangements are hydraulically operated and automatically arranged so that the locating pins locate the cylinder block before the



clamping action takes place. The hydraulic units carrying the cluster heads that drive the tools are also electrically interlocked; the cycle of the machine cannot be started unless the hydraulic unit for the fixture is running. One machine has 8 spindles, the others each have 16 spindles.

Duplex Milling Machine

MILLING two surfaces simultaneously on opposite ends of small workpieces such as lock, key, gun and business machine parts and light cuts on larger workpieces can be accomplished with a small duplex type Rigidmil of the No. 0 size which has been produced by the *Sundstrand Machine Tool Co.*, Rockford, Ill. The machine has two horizontal, opposed spindle heads which have independent vertical adjustment from 2 in. min to 13 in. max from top of table to center line of the spindle, making possible cuts on opposite ends of a part

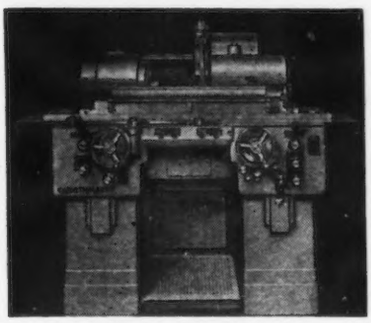


at different heights. Spindle heads are of independent motor driven type; 1 or 1½ hp motors can be used. Heads are available in 2 speed ranges of 25 to 1200 rpm or 50 to 2400 rpm. Speed changes are by pick-off gears and each set of 2 gears provides 4 possible speed changes. The machine has a maximum table feed stroke of 12 in. and rate of table feed is infinitely adjustable between ½ and 38 ipm. Rapid traverse rate is 325 ipm. Feed and rapid traverse movements of the table are hydraulically controlled.

Hydraulic Grinding Machine

DESIGNED for precise center-type grinding operations on small diameters, the Filmatic 4-in. plain hydraulic grinding machine, built by *Cincinnati Grinders, Inc.*, Cincinnati, can be provided with hand or automatic type hydraulic infeed mechanisms, giving the machine high productive capacity for either traverse or infeed types of

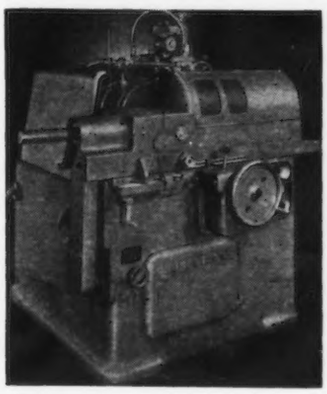
operation. The machine features single lever control of table traverse, work rotation and coolant. Power table traverse is hydraulically actuated and rates are infinitely



variable from 3 to 280 ipm. An independent truing rate of 3 ipm is selected by pushing a rate selector knob, permitting the grinding wheel to be trued without disturbing the traverse rate setting. The standard headstock is of the dead spindle type and is individually motor driven. V belt spindle drive assures smooth rotation. Standard machines are provided with automatic pick feed for traverse grinding and hand cross feed of the wheel head unit for setup adjustments.

Annular Form Grinder

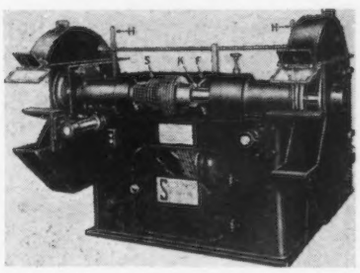
UTILIZING the Crushtrue principle of wheel dressing for the rapid production of annular and cylindrical forms such as circular form tools, crusher rolls, ball bearing seals, seaming rolls and other forms of intricate and precise profile, a precision annular form grinder has been announced by the



Sheffield Corp., Dayton 1. The base, work table, wheel head, wheel feeding mechanism, and semiautomatic crushtruing device are similar to the Sheffield thread and form grinder. However, the work head and work head drive are new. A variable speed geared-head motor drives the work head spindle in either direction through pulleys and two V belts. The work head spindle may be of either live or dead center construction. The live center has provision for manual collet closing with maximum collet size 0.6875 in. Standard work speed range is 60 to 360 rpm and may be varied in infinite increments. A hand crank engages with the lead screw for table positioning, and a fine adjustment knob provides micrometer control of the table position. Using proper wheel surface finish of 10 to 15 microinches rms is said to be obtained using crushing as the means of truing the wheel.

Snagging Grinder

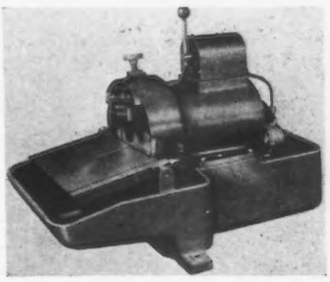
REDESIGN of the No. 30 multiple speed snagging grinder has been announced by the *Standard Electrical Tool Co.*, 2505 River Rd., Cincinnati 4. The machine is available in sizes for 18 in. up to 30-in. wheels. There are three spindle speeds so that grinding efficiency may be maintained throughout



wheel life merely by changing the spindle speed as the wheels reduce in diameter. Interlocking arrangement prevents overspeeding of the wheels. Oil reservoirs are fitted with sight feed oil gages, and there is a shaft lock for use in changing wheels. Power is transmitted to the grinding spindle through a multiple V belt drive.

Bench Type Grinder

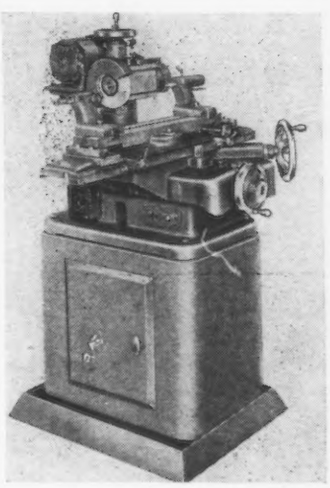
KNOWN as the Wickman-Neven bench grinding and lapping machine, a bench type grinding machine designed for sharpening carbide tools with a steel-bonded diamond wheel has been announced by the *Wickman Corp.*, 15533 Woodrow Wilson Ave., Detroit 3. Power for full use of the wheel is provided by the 1-hp spindle motor, which is of special design to withstand frequent reversal. A coolant pump is standard equipment, with a reservoir cast in the base of the machine. For convenience in sharpening both right and left hand tools, the direct-driven grinding wheel is reversed by a switch on the top of the motor. The wheel guard can be swiveled to



right or left and the 8 x 12 in. table can be set at any angle from 5° above horizontal to 15° below.

Cutter and Tool Grinder

DESIGNED to sharpen reamers and milling cutters of a wide variety of shapes and sizes, the Excel No. 6 universal cutter and tool grinder has been manufactured by the *Covel Mfg. Co.*, Benton Harbor, Mich. The machine is also adaptable for cylindrical and internal grinding purposes. Longitudinal travel of table is 14 in. and vertical movement of the grinding wheel spindle is 7 in. The table surface is 4 x 24 in. with the vertical distance from center of spindle to top of table measuring 9¾ in. max, 2½ in., min. The spindle is

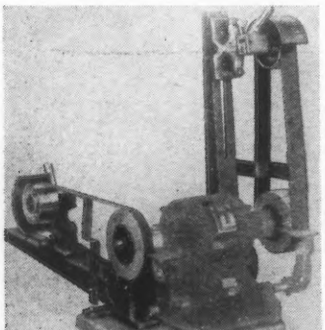


1½ in. in diam, tapered to receive a grinding wheel collet while the other end has a straight ½-in. diam to fit small-diameter cup wheels.

Belt Grinder Attachment

ADDITION of a light, narrow belt grinder attachment, type N-2, has been made to the line of

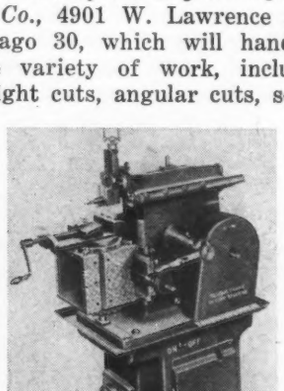
abrasive belt grinders manufactured by the *Porter Cable Machine Co.*, Syracuse, N. Y. The attachment is said to be capable of performing all kinds of light burring and grinding operations and can be



used on plastic materials, steel, iron, aluminum, wood and glass. It is furnished without motor and is quickly alined and attached to a bench type wheel grinder, to which a resilient contact roll has been fitted. The complete unit assembly stands 27 in. high with a width of 2½ in. Platen size for flat grinding is 2 x 4 in. Using an endless abrasive belt 2 x 48 in. the attachment can be used either in the vertical, horizontal or any position between the 90°.

Chain-Drive Shaper

PRODUCTION of a 7-in. shaper of improved design has been announced by the *Logan Engineering Co.*, 4901 W. Lawrence Ave., Chicago 30, which will handle a wide variety of work, including straight cuts, angular cuts, squar-



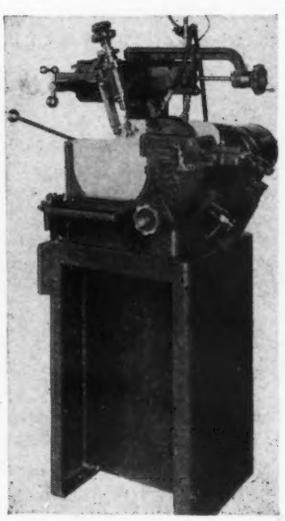
ing, machining and slotting operations. Built entirely of steel and cast iron, with extra weight at vital points, the shaper is said to take heavier cuts smoothly, with speed and accuracy, and without chatter. Roller chain drive provides positive, slip-proof operation. A maximum stroke of 7⅝ in. and any desired operating speed between 64 and 175 strokes per min are possible with the machine. Speed can be changed instantly, without stopping the motor or shifting the belt. The ram is micro-set by a screw adjustment. There are six automatic feeds in either direction from 0.002 to 0.012 in. with a half turn of the feed handle reversing the feed.

Valve Grinding Machine

ANNOUNCEMENT of two improved six-spindle grinding machines designed to grind and lap tapered valve cocks in sizes from ⅛ to 1½ in. ips, including those for steam, air, gases, liquids and railroad cutout and angle cocks, has been made by the *Milwaukee Cock Grinding Machine Co.*, 2357-V North 29th St., Milwaukee. The machines are said to grind and lap up to 300 cocks per hr, and up to six different types of valves simultaneously. Each spindle is separately controlled, permitting each spindle to be loaded individually. The valves while being ground are rotated in a true manner, it is said, and the bodies are selfcentering on the valves, thus insuring a perfectly ground valve seat. Model B is provided with two-jaw chucks for grinding valves with flats on the stems; Model C has collets for gripping round valve stems.

Tap Sharpener

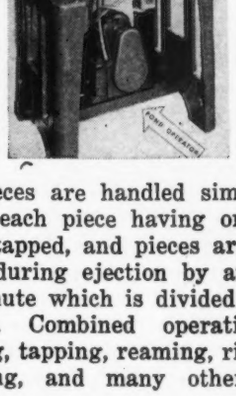
CALLED the Blake Flute Grinder, a spiral point tap sharpener has been announced by the *Edward Blake Co.*, 634 Commonwealth Ave., Newton Centre 59, Mass., which is said to provide positive, mechanical controls for accurate, speedy sharpening of both the spiral points and the straight flutes, not only of taps but also of other straight and angular fluted tools, such as countersinks, drills, etc. The machine is self-contained, incorporating a unique method of holding the tap, it is said. The shank is held in a special radius-grip draw-in collet which grips with sufficient force to keep the tap from slipping in the collet. Locating of the tap for grinding the first flute is accomplished by swinging into position a selfretracting locator arm containing a pawl pin which is inserted into the nearest flute. Completion of the swing of the locator arm turns the tap to the proper grinding position. The workhead spindle



turns to provide the required indexing. The standard machine can handle right and left-hand 2, 3, and 4-flute taps from the smallest up to ⅝-in. tap diameter.

Tapping Control Unit

TO CONVERT hand-operated tapping units to automatics, the *Pond Engineering Co.*, 15 Park St., Springfield, Mass., has designed an automatic control unit which is said to provide a marked increase in the production rate of many small parts. Accurate indexing, locating, clamping, tapping and ejecting are accomplished on a turntable fixture which is actuated by the Pond operator model 600. In the machine illustrated, two differ-

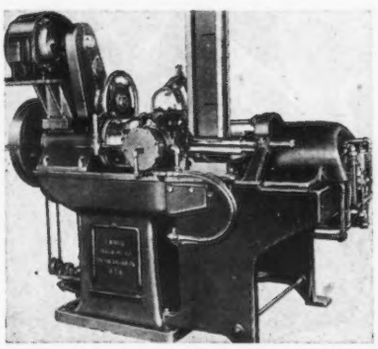


ent pieces are handled simultaneously, each piece having one hole to be tapped, and pieces are separated during ejection by an ejection chute which is divided in the middle. Combined operations — drilling, tapping, reaming, riveting, grinding, and many others—are

possible on this machine. The Pond operator is primarily a control unit with a one cycle air-clutch-operated camshaft, powered by a ⅓ hp motor. A minimum of 70 lb air pressure is required.

Automatic Nipple Machine

DEVELOPMENT of an automatic nipple machine which threads, reams, and chamfers both ends of space nipples automatically has been announced by the *Landis Machine Co.*, Waynesboro, Pa. The machines are built in two sizes: the 1¼-in. machine for ½, ¾, or 1-in. pipe sizes and the 2-in. machine for 1, 1¼, 1½, or 2-in. pipe. Automatic nipple machines have two spindles, each equipped with Lanco internal trip semireceding pipe and nipple threading die head and reaming attachments. The two carriages have air operated vises for gripping



the nipples and the left hand carriage carries an adjustable magazine from which the nipple blanks are fed automatically into the machine. The machines are driven by a constant speed motor, with change gears provided to give the required spindle speeds for the pipe size to be threaded. A safety clutch is built into the drive to prevent damage if a jam should occur.

Lead Measuring Instrument

CHECKING the lead of helical gears and other surfaces can be accomplished with an instrument placed on the market by the *Fellows Gear Shaper Co.*, Springfield, Vt. This instrument checks the lead of a helix by the continuous motion of a measuring pointer, in conjunction with the desired rotation of the work. If the work being checked is of the correct lead, the dial indicator remains stationary; if there is an error, the indicator needle indicates in 0.0001 in. the displacement of the helix in the face width being measured. An integral part of the instrument is an electrical recorder, which automatically produces a record of displacement of the tooth face on a paper

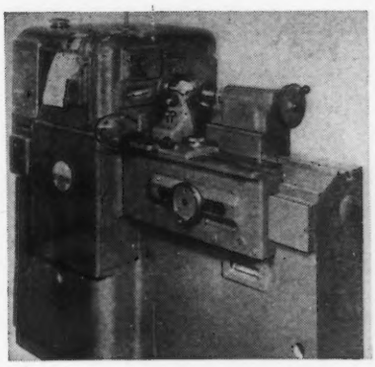
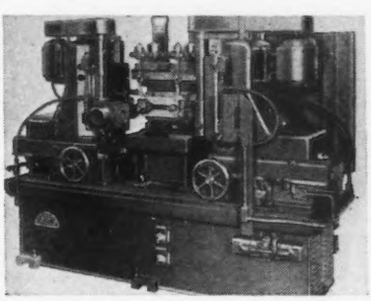


chart. It is possible to have traverse of the measuring pointer without rotation of the work, and rotation of the work without traverse of the measuring pointer. This instrument can also be used for checking taper and crowning of spur and helical gear teeth. It has a capacity for gears up to 12-in. pitch diameter, and a measuring slide movement of approximately 10 in.

Rod Balancing Fixture

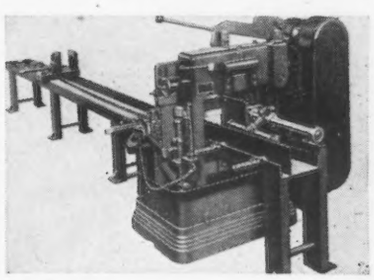
DESIGNED for balancing connecting rods, a special-purpose machine has been built by the *Snyder Tool & Engineering Co.*, 3400 E. Lafayette, Detroit 7, which provides for the part being placed in the fixture and remaining there throughout the operation. The fixture is attached to two scales which register the amount of overweight at either end of the rod. Positive end stops for the depth of the cut



are adjusted by means of handwheels on which the reading is set to correspond with the readings on the two scales. The cycle of the machine, which is automatically clamping the part in the fixture in fixed location, rapid advance of both milling units against their adjusted solid stops and feeding the milling cutters through the work, is started by pushbutton. The machine can take a variety of connecting rods varying from 7 to 13 in. in length. Stock is milled off the connecting rod at both ends with end milling cutters and slab milling cutters. Production estimates are approximately 64 cycles per hr at 80 pct efficiency.

Automatic Metal Saw

AUTOMATIC pull-up and automatic gaging in lengths from ⅛ to 48 in. are made possible through the development of a mechanically controlled power saw announced by the *Peerless Machine Co.*, Racine, Wis. Metal is fed forward within a four-sided saw-frame assembly which surrounds the work as the metal is being cut. When the cut is completed, the conveyor feeds the predetermined length of metal into the saw, the multiple bar-clamping vise releasing and setting automatically. In case of accident of blade breakage, a blade-

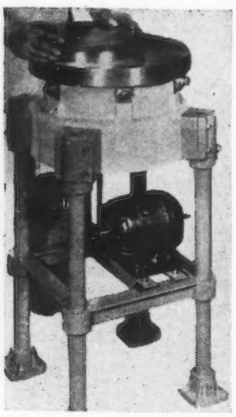


safety, micro-switch automatically stops the machine. When the last remaining stub of metal on the conveyor contacts the limit switch, the cycle automatically stops. The mechanically controlled conveyor is built for the Peerless Mechani-Cut model in 7 x 7, and 11 x 11-in. sizes.

Flat Lapping Machine

A LOW cost precision flat lapping machine has been designed by *Spitfire Tools, Inc.*, 2933 N. Pulaski Rd., Chicago 41, for high speed lapping of single parts or production runs of hardened steel, quartz, glass and parts. The machine rapidly and easily finishes each piece to a high polish and precision flat finish and size. It is possible, it is claimed, to obtain a surface finish as fine as 2 microinches rms. Single pieces ordinarily require no holders, chucks or collets; the operator lays the piece on the revolving circular lapping plate and directs its motion with his hands. Production lapping of large quantities of small parts is done rapidly by

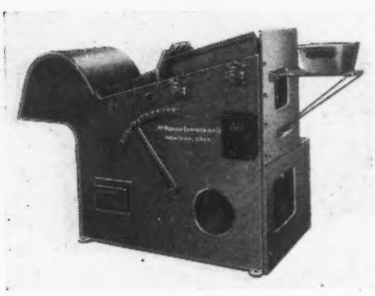
use of standard or special holders to suit the particular requirements. Extra standard or special lapping plates for various uses are available. These plates are



put on and taken off the machine without tools of any kind, as no bolts, screws or fastenings are necessary to hold the plate on the machine.

Chip Separator

MODEL D chip separator, an improved model which uses no screens and no belts has been announced by the *McKenzie Engineering Co.*, Newtown, Conn. The machine separates the finished parts from the chips of steel, brass and aluminum after the oil has been extracted. It will separate parts as small as ⅛ in. diam x ¼ in. long as easily as larger parts up to 1½ in. diam, 5 in. long, also parts from long steel chips. Model D has two motors, a 3-hp motor coupled direct to blower and a ¾-hp motor which runs the vibrators with a



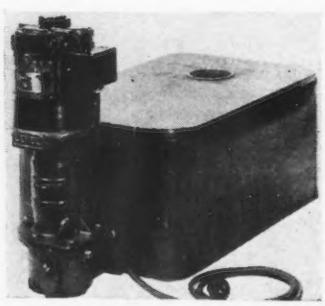
short chain drive. Both motors are inside the separator and connected to a starter switch. Separated parts fall into pans provided with the separator and they can be put in or taken out from either front or back. Chips can be blown some distance into bin, conveyor, or outside. The machine will handle a bushel of material in 1 min, it is said.

Grinding Fluid

DEVELOPED for use with the Quaker Microgrind Process, a water soluble grinding fluid has been announced by the *Quaker Chemical Products Corp.*, Conshohocken, Pa. The fluid, designated as Microgrind 70, can be employed on abrasive operations on all types of steel and most other metals. It is claimed that the product cannot develop rancidity, even when mixed with hard water or when used for grinding cast iron, and can be used for three months or longer without change if makeup is added periodically. The product cannot cause build-up on machines, it is said, but will help to keep them clean. Microgrind 70 has a highly detergent action on abrasive wheels which causes them to be kept open and free-cutting.

Coolant Pump

AS AN accessory to machines where a free flow of coolant is required, a coolant pump has been developed by the *Delta Mfg.*



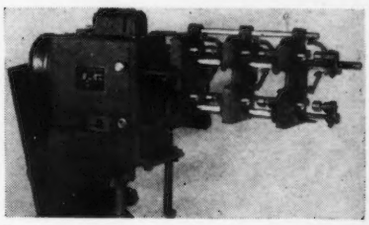
Div., Rockwell Mfg. Co., 600 E. Vienna Ave., Milwaukee 1. The pump is adaptable because the flat machine flange permits use on most wet machine tools. It has a capacity up to 30 gpm at low heads and will deliver water up to 2 gpm to a 14-ft head. The ¼-hp motor is fully enclosed and double-sealed.

Cutting Oils

TRANSPARENT cutting oils for use in high temperature machining of metals have been announced by the *Texas Co.*, 135 East 42nd St., New York. Known as Cleartex cutting oils, A, A-1, B, DD and Britex cutting oil B, these products contain certain war restricted ingredients said to improve their color and performance. The oils in the series contain a combination of sulfur and chlorine, permitting high cutting speeds without the danger of corroding finished or semifinished metals.

Multi-Chuck Coil Winder

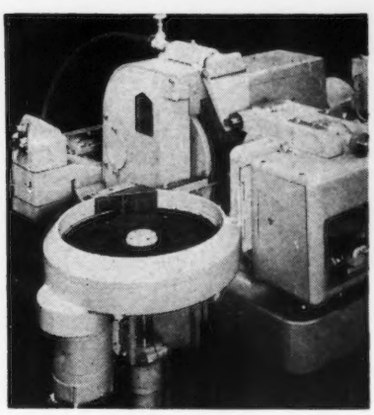
ANNOUNCED by the *Globe Tool & Engineering Co.*, Davis Ave., Dayton 3, is a coil winding machine, said to allow high production through multiple-winding, of coils which must be wound singly. Small solenoids, paper form and



solid core relays, cross wound radio coils, etc., can be wound in this machine, which is identified as the Multi-chuck. The winder has a selectable number of winding stations, each adding a spindle to both a running row and an idle row of spindles. The operator reloads the idle spindles while the running spindles go through an automatic cycle. Shifting a lever causes the reloaded spindles to wind. Sufficient number of stations, to a maximum of eight, are selected to match operator time against machine time. Normal traverse is available for level winding, while rapid traverse is available for cross wound coils.

Feeding Hopper

AUTOMATIC feeding hoppers developed for use with No. 2 centerless grinders, used in grinding carbon sticks for dry batteries



have been announced by *Arthur Scrivener, Ltd.*, Tyburn Rd., Birmingham, England. It is claimed with this combination of grinder and hopper standard carbon sticks 6 mm diam x 54 mm long are ground to a tolerance of 0.001 in. at the rate of 30,000 per hr.

MESTA

TIN SHEARING LINES

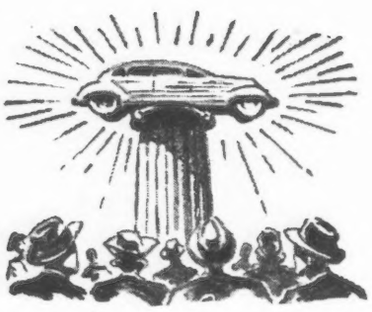
Mesta 42" Tin Shearing Line,
Showing Mesta Patented Flying Shear
and Leveller with Classifying and Piling
Equipment in Background

MESTA MACHINE COMPANY · PITTSBURGH, PA.

Assembly Line . . .

WALTER G. PATTON

• Use of steel in motor cars may lag far behind delivery of the steel . . . Motor producers fighting an uphill battle against unbalanced inventories . . . Unions announce wage demands on foundries.



DETROIT — During most of 1946 the automobile industry has been on a hand-to-mouth, stop-and-go basis for many parts and raw materials. Automotive inventories, although large in the aggregate, are still dangerously low in many categories. Flat-rolled steel is most frequently mentioned as the top critical item, although copper, lead, foundry coke and pig iron are potentially just as dangerously short.

The industry has long ago been brought to the stern realization that any work stoppage that chokes the flow of parts to automobile pipe lines will eventually appear, sometimes months later, as a threat to continued automobile production. The essential time lag between the ordering and delivery of automotive steel, for example, is one of the least understood phases of the industry's operation.

For instance, the production of automobiles may involve an elapsed time of 120 days between the time fabrication begins on axles, transmissions and other parts, until these units are actually installed in a new car. More than a month may be required to fit the steel into forging schedules. Following this the part must be delivered to the auto plant and make its way to the final assembly line.

Fenders, on the other hand, are a relatively short-term item requiring usually only 30 days from the time the sheet steel is delivered until the finished fender is placed on a car body.

Other automobile parts require extensive and time-consuming processing. Crankshafts for example must be ordered as early as 9 months in advance. Three months of this time are required to fit the forging into a car company's production cycle. For this reason the effects of last spring's steel strike which lost 12 million tons of steel may only now be reflected in the production of certain types of forgings.

WITH delays and uncertain deliveries of parts and raw materials resulting in repeated cutbacks in automobile production schedules, inventories have climbed steadily. Normally the industry plans to turn over its inventories on an average of 14 times a yr. Supplies of certain items on which deliveries are regular and storage is impractical may be turned over as many as 30 times a year. Like five-and-ten cent stores, the automobile industry has always planned to turn over its merchandise quickly.

At present the industry has a constant uphill fight on its hands trying to keep inventory banks from getting out of control. Here is an example of what is taking place.

Recently a strike of only 80 men in a certain plant making automobile brake drums closed down another company making passenger car wheels. With the flow of wheels stopped, assemblies at several automobile plants were immediately threatened.

Meanwhile, other producers seeing this threat to their production schedules had to decide quickly whether to shut off the incoming flow of carburetors, body frames, radiators, etc., needed for production or to build up banks of parts.

COMMITMENTS with suppliers usually cannot be shut off immediately even if the buyer may desire to take such drastic action. Upholstery cloth orders, for example, cannot be canceled overnight with the expectation that a new order can be placed next week since it usually requires up to 6 months advance notice to get an order on the looms. Under these conditions, cloth already ordered must be accepted as ordered regardless of the fact that a car company's production may be slowing down.

The same situation would be found in the case of crankshaft forgings. Many types of castings also require a long time between the placement of the order, pouring of the casting and delivery of the finished product.

Thus the mountain-like inventories the automobile companies now have on hand are readily explained; what is not so clear is what the producers are going to do to keep their inventories within bounds. There are indeed many factors in the situation over which the automobile producers have little control and it is these factors, in the final analysis, which will determine the final course of action adopted by the automobile producers when production schedules have to be revised.

On the eve of the threat to tie up the coal industry, the automobile companies established another near record production for the year 1946, assemblying 94,640 units as compared with the previous week's 92,760 according to Ward's Reports. By comparison, the previous year's total looks small with only 30,165 units turned out in 1945. It is significant that during the same week of 1941 only 92,990 units were built. Of this week's total 55,040 were American-built passenger cars and 25,150 were U. S.-built trucks.

MOST observers agree that the outlook of the automobile industry has brightened somewhat since OPA drew its final breath.

Improved

"MAXI"

Surface Treated Taps

You can again get "MAXI" surface treatment on "Greenfield" Taps at no extra cost.

"MAXI" was a pre-war champion when it came to tap performance. Today's "MAXI" is *better than ever*. Intensive research in "Greenfield's" metallurgical laboratory during the war has produced better formulas for surface treatment.

WHAT IS "MAXI" FINISH?

It is a heat treatment applied to High Speed Steel tools which imparts a surface hardness greater than that of an untreated tool. This surface is applied by a chemical bath. It does not affect the basic character of the metal nor the size of the tap.

COSTS NO MORE!

You can get a "MAXI" surface treatment on any "Greenfield" HIGH SPEED tool, regular or special, in any size at no additional cost. Simply add the word "MAXI" when ordering.

GTD

GREENFIELD

GREENFIELD TAP and DIE CORPORATION
GREENFIELD • MASSACHUSETTS

TUCKER TALKS TURKEY: *Preston Tucker, left, whose plans to build a new motor car in the Chicago Dodge-Chrysler war plant ran into those of Lustron, Inc., which wants to build prefabricated houses there, is shown here with his attorney as he appealed to the Senate War Investigating Committee on the deal.*

Automobile manufacturers are hopeful of finding both steel and nonferrous metals in better availability. The outlook for sheet steel as well as wire products is improved and some observers are even predicting that deliveries may reach nearly normal early in 1947, providing Lewis does not upset the industrial applecart.

Similarly, a better future is seen for lead, copper and zinc. With domestic mining activity improved and prospects somewhat better for importing these scarce materials, the automobile industry is actually evidencing some optimism about the future. The big problems at the moment are the coal supply and the possibility that soaring scrap prices may force a substantial increase in the cost of basic steel.

Gray iron castings may also be in line for a price jump early in 1947. A wage demand handed to a Detroit gray iron foundry this week called for a 25¢ wage boost with a 10¢ differential for second shift work, two weeks' vacation with pay, old age pensions, a closed shop with the check-off, and payment of hospitalization insurance by the company. This particular foundry is currently paying $1.68 per hr to molders.

During the past week the 500,000th Chevrolet built in the United States came off the assembly line. Although strike-bound during the first quarter of 1946, Chevrolet has come back fast. During the months when the Chevrolet plant was in operation, the company has been outstandingly successful in combating material shortages, suppliers' strikes, uncertain worker productivity and other factors which have tended to hold production at low levels.

Of the half million vehicles built by Chevrolet more than 40 pct are trucks. Figures show that 57 pct were passenger cars while 43 pct were trucks.

With the volume Chevrolet and other General Motors units are now turning out, the recent price increase of $100 in General Motors cars takes on real meaning. During the week ended Nov. 16, total production of General Motors units was 41,475, and output for the month of October was 171,832, according to Ward's Reports.

Index of Industrial Training Films Has 159 Titles on Metals

New York

• • • **An index** of training films containing 159 titles on materials and metals subjects alone has recently been made available to industry without charge, its purpose is to correlate film subjects and the sources from which they may be obtained.

Personnel training departments in the materials and metals industry actually discovered the advantagse of training films during the war years. To meet unprecedented wartime demands, most companies had to train large numbers of inexperienced workers in the shortest possible time. Faced with this crucial problem, materials and metals fabricators were delighted to find in the movie film a remarkable instructional aid, which materially shortened learning time for many workers.

In common with many other industries, materials and metals personnel departments learned their need for a comprehensive, well-indexed guide which listed and described available industrial training films. Many times an instructional problem was made more difficult because source information relating to industrial training films was too scattered to be effectively used.

This was largely due to lack of a well-organized inventory of industrial training films, which featured brief descriptions of all listed titles. With many companies planning to adapt movie films to their instructional needs for peacetime production operations, the demand for a broad, easy-to-use catalog of available industrial training films became more apparent than ever.

Realizing that full utilization of film for industrial training needs was being retarded for want of a good guide book, the editors of *Business Screen* magazine produced *The Index of Training Films* to let industrial personnel training departments know what kind of films were available and how they could be obtained. This guide lists more than 1700 motion picture and slide films, which can be secured from 269 sources.

Free copies of *The Index of Training Films* can be obtained by writing Eastman Kodak Co., Rochester 4, N. Y.

Materials and Metals	
Aluminum	6 titles
Ball Bearings	5 titles
Copper	12 titles
Heat Treatment	10 titles
Iron and Steel	66 titles
Lead	4 titles
Magnesium	3 titles
Mica	1 title
Nickel	7 titles
Pipe and Tubing	4 titles
Plating	5 titles
Tin	1 title
Wire	5 titles
Miscellaneous	6 titles
Foundry and Forging	
General	4 titles
Die Casting	2 titles
Forging	3 titles
Melting Practice	2 titles
Molding—Bench	6 titles
Molding—Floor	5 titles
Molding—Machine	2 titles

USE SPRING LOCK WASHERS

TO DEFEAT RUST AND CORROSION

Rust . . . corrosion . . . deterioration of metal parts often means loose assemblies and breakdowns unless the bolt or screw is equipped with a spring lock washer.

A spring lock washer, **like a Diamond G Lock Washer, will keep a constant tension between the bolt, the metal parts and the nut. Any loosening that may take place because of rust or corrosion is immediately taken up by Diamond G Controlled Tension.**

Remember **there is only one *Diamond G Controlled Tension Lock Washer.* This exclusive tension quality is built into every Diamond G Lock Washer by precision fabrication and heat treating. It permits full tightening of bolt and screws, safeguarding against excessive vibration, shock and wear.**

Next time **specify Diamond G's! For samples and full details on the new ASA and SAE specifications on spring lock washers just write to . . .**

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MANUFACTURERS OF

DIAMOND G PRODUCTS

LOCK WASHERS • • FLAT WASHERS • • STAMPINGS • • SPRINGS • • HOSE CLAMPS • • SNAP AND RETAINER RINGS

Washington . . .

L. W. MOFFETT

• Harassed WAA and FLC with mountainous surpluses at home and abroad moving slowly toward improved disposal program . . . Get only 28 pct return.

WASHINGTON — The surplus property situation has been a perpetual sore spot with Congress which from time to time has leveled caustic criticism not only at the War Assets Administration (domestic surplus) but at the Foreign Liquidation Commission (overseas surplus) as well. The lawmaking body has been irked because neither agency apparently had any clear-cut facts as to how much surplus there was, what it consisted of, or where it was located.

A turn for the better seems to have been taken in this respect. The FLC—under pressure by UNRRA and hamstrung by governmental commitments to foreign powers—now appears to have the problem well in hand. As to the domestic situation, WAA Administrator Robert M. Littlejohn, fed up with the lack of information, has added accountants to the staff and has issued sharp orders to the field that inventories must be brought up to date and kept that way.

Also clarifying the atmosphere to a certain extent are current reports prepared for Congress by both the WAA and the FLC. Completed at the same time and covering the same period—from the beginning of surplus disposal through the third quarter of 1946—the reports give industry and the taxpayer the first reasonably clear view of what a tremendous licking they are taking in both material and money by reason of surpluses acquired because of war necessity.

These reports show that the end of the war in August 1945 left the country with about $44 billion in surpluses; nearly 15 months later, as of Nov. 1, 1946, the nation still had approximately 70 pct of the total or about $31 billion worth on its hands. Nearly half of the remainder, or roughly $15 billion, had not yet been declared surplus by the owning or holding agencies.

On the basis of these figures and including the $1½ billion worth disposed of in ways other than by sales (by lease, donation and abandonment), the net return to Uncle Sam on disposals to date is approximately 28¢ on the dollar of acquisition cost. This recovery rate may be expected to decline as the cream of the goods is sold.

SUMMING up the operations of WAA as of the end of the third quarter of 1946, Administrator Robert M. Littlejohn estimated that roughly a grand total of $34 billion in domestic surplus will ultimately have been declared. Of this amount, the report showed that $21.5 billion worth had been acquired up to Oct. 1, thus leaving $12.5 billion to be declared.

Of the surplus acquired thus far by WAA and other disposal agencies, $6.3 billion has been cleared from the inventory records. Some $5.3 billion of this amount is represented in sales for which a return of $2.1 billion was obtained. These figures did not include the September sale of aircraft and components, originally costing the government $3.9 billion, for which the records had not then been completed.

Deducting the aircraft sales from the total, however, leaves WAA with an inventory of $11.3 billion. Adding to this figure the property yet to be acquired, the WAA is still faced with the job of disposing of $23.8 billion before it can close its doors.

Orders have been issued to WAA field offices that no effort is to be spared in an attempt to clear the books of 75 pct or more than $8 billion worth of the current inventories before the first of February. Site sales will be increased and in the sales drive the staff of 53,000 will be built up to approximately 63,500 by the end of the year.

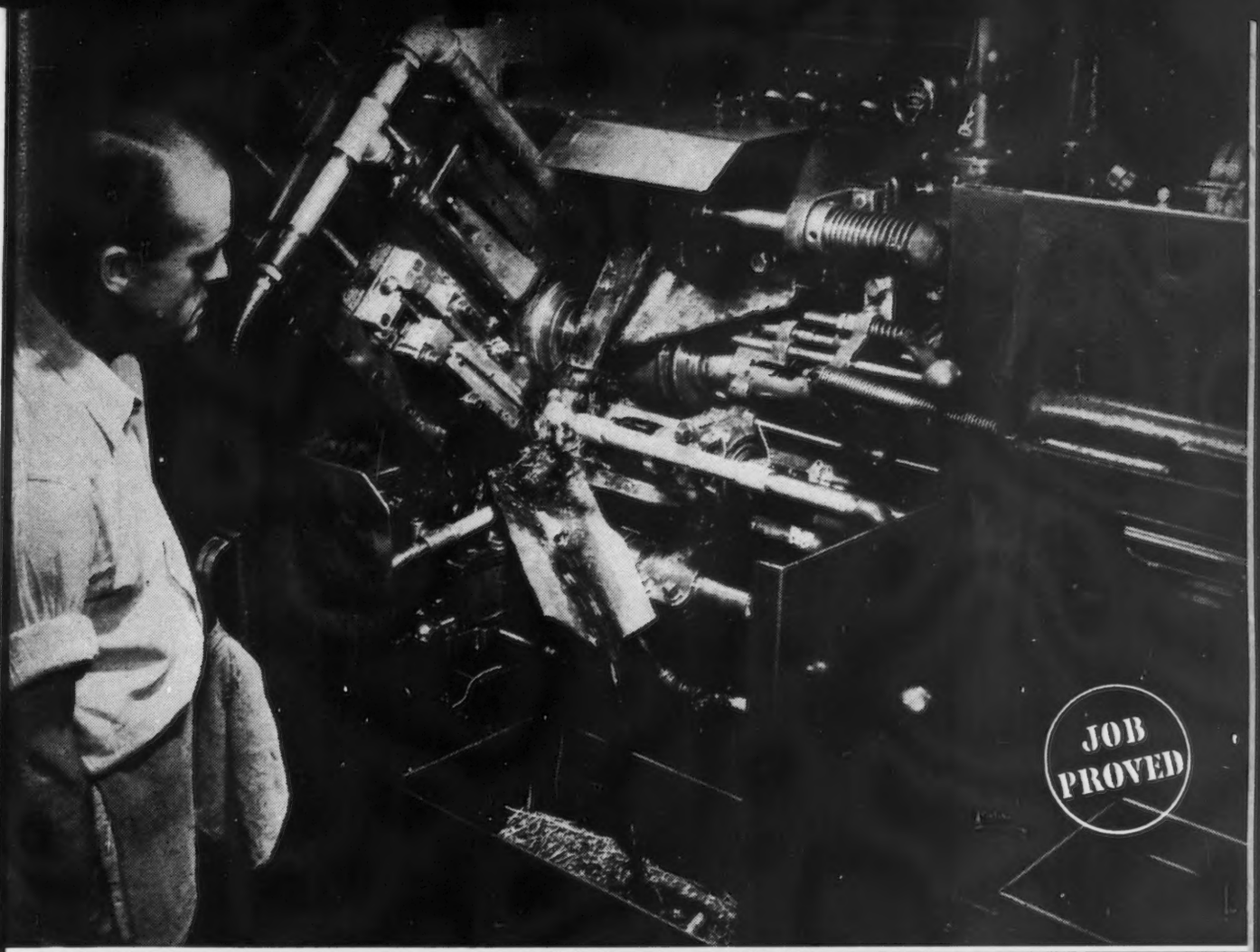
At the beginning of the fourth quarter, WAA was practically out of the aircraft business the report showed. Only 3000 tactical craft remained in the United States for disposal; these were to be crushed to meet scrap commitments. Bids were in the process of being awarded for scrapping the additional 2265 combat planes remaining in Hawaii. Left in stock were 7000 civilian type planes which probably will be disposed of before the end of the year.

Real property presents a longer range and slower-moving program. Of the $5.8 billion worth of war plants, shipyards and airports declared, $1.2 billion had been sold, $1 billion placed under lease, and another $100 million disposed of otherwise, leaving a current inventory of around $3.5 billion.

Government war plants are on the way to becoming a drug on the market as the bigger firms show less interest and many surplus installations are beyond the reach or needs of smaller businesses. A WAA survey reveals that to date only 65 of the 250 largest corporations have bought or leased surplus plants. An added damper on large corporations acquiring more property is the ever-present threat of prosecution on charges of violation of the anti-monopoly laws.

IT is thus indicated that WAA'S greatest future efforts must be directed toward disposal of consumer and producer goods. Already the market for this type of surplus is shrinking as industrial production increases and tends to fill pipelines and partially meet long pent-up needs and demands.

The WAA report shows that it has been able to dispose of less than half of the goods in this category. Through September, some $7 billion had been acquired



Tapping AND *Threading* S.A.E. 4140 STEEL

SUNICUT . . .

Makes possible fast production of fine threads

Here's an operation where Sunicut helped produce fine-finish threads on tough steel at relatively high speed.

Type of Machine: New Britain Gridley automatic screw machine, 2" capacity, No. 61, six spindles.

Metal: S.A.E. 4140 bar stock.
Operation: Forming, drilling, tapping, and threading.
Speed: 85 SFPM

SUNICUT is a free-flowing, transparent, correctly balanced sulphur, lard, and mineral oil combination. It has been "Job-Proved" in hundreds of shops. For additional proof of what Sunicut can do for you, test it in your own shop under your own operating conditions!

SUN OIL COMPANY • ***Philadelphia 3, Pa.***
Sponsors of the Sunoco News-Voice of the Air — Lowell Thomas

SUN
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INDUSTRIAL PRODUCTS

against disposals of $3.1 billion. Perhaps indicative of the task ahead and that less marketable goods remain to be sold is the fact that sales for the third quarter of 1946 dropped 25 pct below those of the second quarter. While WAA believes that part of this sales recession was due to reorganization and diversion of personnel in preparation for expanded site sales, it freely admits that henceforth "greater sales efforts will be required to move a given dollar volume."

In contrast with WAA operations, the FLC's job consists of disposing of property in not one but more than two-score countries. Adding to the complexities of its work is the fact that as the State Dept. agency it has been saddled with overseas administration of lend-lease and the responsibility of terminating that agency's operations. In addition, it has had to fulfill commitments made to foreign governments and consider the demands of UNRRA.

Property having an original cost of $7.58 billion has been turned over to FLC for disposal. Currently, the agency has completed arrangements for getting rid of $6.47 billion, of which some $5.87 billion might be loosely termed as outright sales. By adding to the current inventory of $1.1 billion the estimated $2.5 billion, the FLC still faces the prospect of disposing of $3.6 billion in one way or another.

The $6.47 billion in disposals represent roughly about 85 pct of cumulative declarations and have netted a return of $1.49 billion or 23¢ on the dollar of original costs as compared with 33¢ recovery by WAA on domestic surplus sales activities.

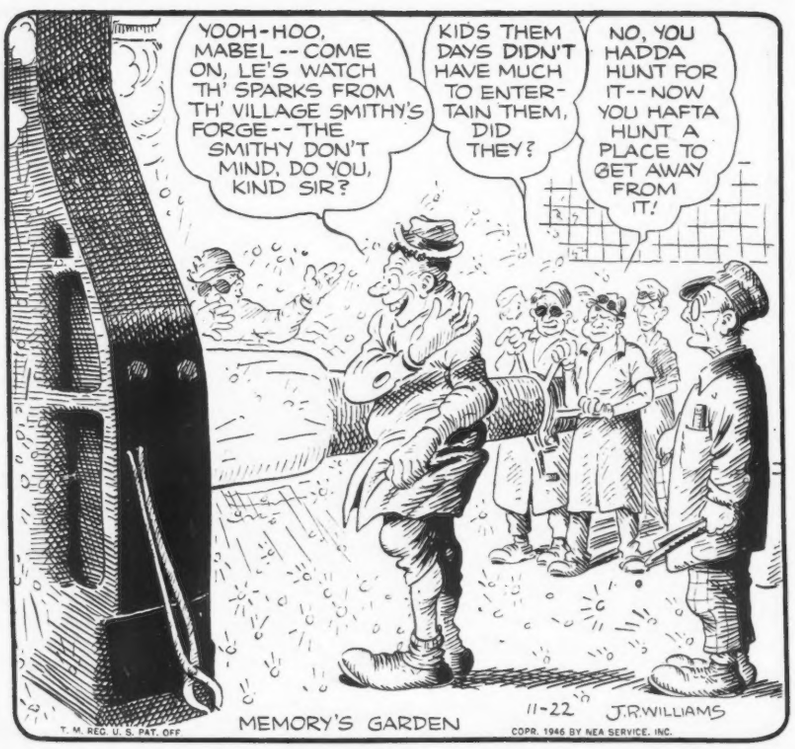
SURPLUS PROPERTY, ACQUISITION AND DISPOSAL

All Agencies (in millions)

	Acquired	Disposals (Cost)	Received	Inventory	To Be Declared
DOMESTIC AGENCIES					
War Assets Administration	$20,778	5,866	1,985	13,869	12,500
Department of Agriculture	183	104	68	79	.....
U. S. Maritime	113	89	28	23	.....
National Housing Agency	58	26	8	27	.....
Federal Works Agency	97	71	.5	26	.....
Department of Interior	253	106	24	119	.....
Totals	$21,482	6,262	2,113.5	14,143	12,500
OVERSEAS AGENCIES					
Foreign Liquidation Commission	$ 7,584	6,474	1,494	1,109	2,500
Army Direct Sales	.....	46	33	.....	.....
Navy Direct Sales	.....	71	23	.....	.....
Sales of Scrap	.....	.....	36	.....	.....
Totals	$ 7,584	6,591	1,586	1,109	2,500

In reporting surpluses and disposals, both WAA and FLC assume responsibility and include in their overall reports the disposals by all agencies within their respective classifications(domestic and overseas). The apparent discrepancies in the above totals with those in Washington Comment is due entirely to rounding out the figures in the table above to the nearest million dollars. The table is compiled by THE IRON AGE on the basis of information obtained from WAA and the Foreign Liquidation Commission reports.

THE BULL OF THE WOODS — BY J. R. WILLIAMS


YOOH-HOO, MABEL -- COME ON, LE'S WATCH TH' SPARKS FROM TH' VILLAGE SMITHY'S FORGE -- THE SMITHY DON'T MIND, DO YOU, KIND SIR?
KIDS THEM DAYS DIDN'T HAVE MUCH TO ENTERTAIN THEM, DID THEY?
NO, YOU HADDA HUNT FOR IT -- NOW YOU HAFTA HUNT A PLACE TO GET AWAY FROM IT!
MEMORY'S GARDEN
11-22
J.R.WILLIAMS
T. M. REG. U. S. PAT. OFF.
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FLC disposals fall into four general classifications which, with the amount accounted for by each, are (actual cost price): (1) Sales to foreign governments, charitable agencies, United States veterans and business firms, foreign nationals and others, $5.87 billion; (2) transfers to UNRRA as a part of the United States contribution to that agency, $142 million; (3) donations to charitable, religious, and educational institutions, $34 million; and (4) property abandoned after being determined unsalable, $427 million.

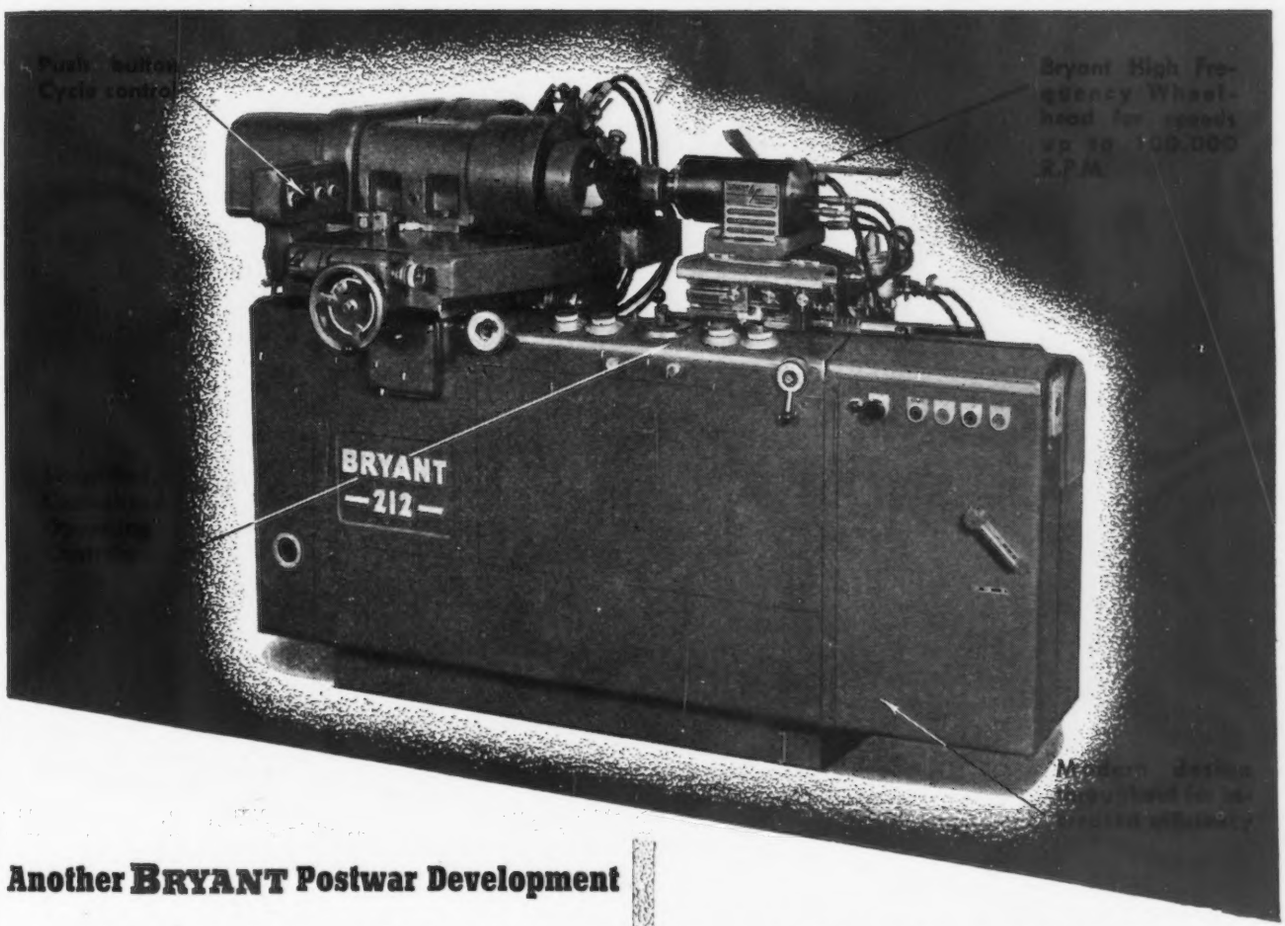
Foreign governments or their agents have been increasingly eager to obtain American goods at bargain basement prices. This is reflected in the report of FLC. which shows that 83 pct of the total sales have been made to such customers. The remaining 17 pct has been sold largely to UNRRA (not counting the nonrenumerative donations ordered by the government at home) with some sales to foreign and American business firms and nationals and scattered agencies.

SALES amounting to $125 million were made for authorized foreign currencies or commitments to pay such currencies while real estate deals or commitments accounted for $33 million more. Surplus goods were fully utilized in fulfilling a $30 million commitment for "cultural" exchanges as authorized by the Ful-

(CONTINUED ON PAGE 122)

Announcing a New Automatic High Production Internal Grinder

No. 212



Another BRYANT Postwar Development

The new No. 212 Bryant Grinder is designed to fill the pressing need for greater production per man hour. It is a fully *automatic* internal grinder that requires a minimum of operator attention—in fact on many jobs one man can run two machines. Production is higher, more precise and more profitable with this new grinder.

The new No. 212 Bryant roughs and finishes bores from 5/16" to 6" (approx.) in diameter in lengths up to 3 inches. On the smaller bores, it is especially suited to the use of *Bryant High Frequency wheel spindles which operate at speeds up to 100,000 r.p.m.*

The No. 212 design incorporates the superiority of Bryant three point wheel slide suspension and insures maximum rigidity under all conditions. Movements of the machine are hydraulically operated, while the cycle is controlled electrically to facilitate change-over. Sizing is accomplished accurately and automatically by any one of three methods: a plug gage mounted in the work spindle, a diamond tipped bore contact, or controlled by the wheel truing diamond. It *roughs* and *trues* and *finishes* and stops *automatically*—producing parts with fine work finish to tolerances that insure bores that are straight and round, making the products which you manufacture more desirable because they run smoother and live longer.

If grinding figures in your production plan, your move for best results is to—

SEND For The Man From Bryant.

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

West Coast . . .

ROBERT T. REINHARDT

• Scrap shortage places West Coast steel producers in more vulnerable spot during coal strike . . . Low motor truck rate from Geneva stirs little interest . . . Los Angeles to become Detroit of the West.

SAN FRANCISCO—With scrap inventories at near-record lows, and pig iron charges getting heavier contrary to past practice, West Coast producers of steel expect to be harder hit by a prolonged coal strike at this time than they were earlier this year.

The two principal openhearth—operator—Columbia Steel Co. and Bethlehem Pacific Coast Steel Corp. —normally charge up to 90 pct scrap, but since this material has become more difficult to get and the price has gone up, pig iron charges constitute larger proportions. Kaiser Co., Inc., at Fontana had already reduced production to four of its six openhearths because of the scrap shortage and relied still more on the production of its blast furnace.

Under these conditions it is apparent that western openhearths are in a precarious position and are on a par with those of eastern operators as coal supplies dwindle.

Columbia is in a particularly bad spot because its Ironton blast furnace has been down for several weeks for relining and its pig reserves have dwindled. While it is ready to be blown in, it will remain cold because of the fear that it may have to be closed down due to a coke shortage and thus damage the new lining.

Geneva Steel Co. plant, nearing 50 pct ingot capacity and operating two of its three blast furnaces, faces the possibility of having to close down both of these within a month even with curtailed wind. The coke ovens are being fired at as low a rate as possible to prolong operations.

The Kaiser plant reports approximately two to three weeks' supply of coal on hand if it is carefully allocated. Full operation would probably exhaust the supply in a week. Even by stretching the limited supply to the maximum it is possible that openhearth production will have to be cut in half soon after Thanksgiving.

Bethlehem operations which depend more heavily on scrap than other major producers are particularly vulnerable to curtailments as inventories are extremely low and pig iron has been so tight that there is little hope of falling back on it for continued operations.

Best estimates here place production of ingots at about 50 pct of capacity of western plants within two to three weeks if the coal strike is continued. Present rate of operation has been around 80 pct.

RECENT announcement that the ICC had approved a reduction in the motor freight rate on steel plate, sheet, structurals and bars from Geneva to San Francisco and Los Angeles was received here without too much enthusiasm, although there were some who hoped it might be a harbinger of things to come from the railroads.

The new rate, which is 40¢ per cwt in minimum truck loads of 35,000 lb, is comparable to the rate being sought from the railroads. The previous truck rate was 58¢ per cwt with a minimum of 20,000 lb.

There is some question as to whether the new rate will be attractive to truckers unless they are passing through Utah with empties bound West. Other obstacles to extensive shipments by this method are the problems involved in loading and unloading, as practically all trucks on these long hauls are closed bodies and while loads may run up to 40,000 lb the length limit is normally 30 ft.

One advantage of the truck haul is the frequency of service—one line sending a westbound truck through Utah every 4 hr—and another is that the trip takes only 36 hr.

LOS ANGELES—Southern California has become an important automobile assembly center. Between 15,000 and 17,000 workers will be employed here in this industry when new and expanded plants are completed. This was a prediction made at a meeting to give a salute to the motor car assembly industry. It is expected that 650,000 cars will be assembled here annually when full production schedules are reached, making Los Angeles second only to Detroit in automobile assembly.

Four new plants are now either under construction or in the process of being converted for car assembly. Many local manufacturers are now supplying parts and original equipment to the assembly plants, notably tires, batteries, seat covers, springs and bumpers. However, the increased production schedules of the local assembly plants are now bringing other local industries into the picture as suppliers.

Construction is now under way on the first Lincoln-Mercury assembly plant outside the Detroit area. Chevrolet is building a passenger car and truck and Fisher Body plant. Government-owned Douglas aircraft plants at Long Beach and El Segundo have been leased to Kaiser-Frazer and Nash Motors respectively. These four plants are in the process of being readied for production and the Kaiser car is scheduled to come off the local line early in 1947.

The "old standbys," which turned out 154,000 automobiles in the last prewar year—Ford, Chrysler, Studebaker and General Motors—are all in production now.

General Motors vice-president Thomas P. Archer stated that when all GM units are completed and producing, this area will assemble slightly more than 10 pct of GM's national production.

At the end of the war, General Motors' statistical analysts calculated that there was sufficient pent-up demand for automobiles in this country to support production of at least 6 million cars and trucks annually for 2½ to 3 yr, before the backlog of orders could be satisfied.

Check Ex-Cell-O's Capacity for the Mass Production of Precision Parts

With a complete organization under one responsible management . . . *an organization built upon years of varied engineering experience, modern machining methods and heat treat facilities, and practical inspection staffs* . . . Ex-Cell-O probably has the exact solution to the parts production problem you face. The above folder illustrating Ex-Cell-O's complete parts production facilities will be sent you upon request. Write or wire Ex-Cell-O today and ask for Ex-Cell-O Bulletin No. 36151.

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EX-CELL-O CORPORATION

DETROIT 6, MICHIGAN

45—133

"Some 15 months after VJ-Day we are unable to produce more than about 70 pct of our prewar capacity. The plants which we had planned to use for expansion are still incomplete, due to delays in obtaining needed materials. Some of them will not be finished until early next summer; but even if they were completed now, they would not effectively increase the total output of automobiles, because conditions have made it impossible to use existing facilities at maximum capacity," Mr. Archer pointed out.

SALT LAKE CITY—Removal of price ceilings from nonferrous metals will do little to stimulate lead and zinc production in this area unless the free price goes high enough to exceed the old ceiling plus premium, according to some producers. The price increases to date have resulted in a small loss to most lead and zinc producers. The reason is that premiums are being reduced by the amount of the price increases, leaving the operator with the same net price but a somewhat higher smelter charge.

Production of these metals is being increased moderately, however, for another reason. Since settlement of the strike last summer most operations have been on a five day a week basis. But operators are finding it impossible to hold their men unless they go to a 6-day week with the one day of overtime. As a result all but a few mines have recently moved into the 6-day operation and the remaining ones are expected to follow suit in the near future.

Inasmuch as copper production in this state was largely nonpremium, the elimination of ceilings and subsequent price increases will provide a spur for increased production of that metal.

SEATTLE—Heavy industry in general and steel production in particular, already harassed by scrap shortages, pig iron shortages and burdened with the coal strike, had added to its worries the heaviest snowfall in history for this time of the year. The recent storms have had more than a minor effect on production in this area.

Absenteeism at major plants such as the Boeing Aircraft Co. has been high. This company reported that approximately 18 pct of their employees were absent for several days last week. Other plants report similar conditions and where second shifts have been operating, the percentage of absenteeism has been considerably higher. The overall effects of this curtailment of production will not be fully overcome for several months because of the limited component inventories upon which some operations have been carried out.

The Isaacson Iron Works is reported to have lost one complete shift and part of another when power shortages developed because of the storm.

This company's operations have been particularly hard hit by the scarcity of scrap and aside from their tractor and winch division, which gets much of its parts from subcontractors, the plant is operating at only about 25 pct efficiency. Ordinarily three shifts are kept busy but at present it is possible to provide material for only two shifts working five days a week. The shortage of scrap is so serious that recently it was necessary to close down forging and machine shops for a week in order to prepare scrap which is reportedly of a very poor grade.

Conditions have improved somewhat in the last week and they report that they now have approximately two months' supply for present operating rates.

The prevailing increase of $2.50 per ton for the principal grades of scrap has had little or no effect in bringing out this much needed material according to local buyers. However, both buyers and sellers in the area seem to be satisfied with the increase in price and attribute the lack of scrap to the decline of abandonment and obsolescence of heavy machinery and automobiles. Here as elsewhere on the Coast at least, the great hope is that the scrapping of ships will be expedited. Of course, during the recent storms, collection and movement of scrap has practically ceased and made the situation more acute in many instances where inventories were already down to the ground level.

BECAUSE of the heavy production of metallurgical and chemical ores in the Pacific Northwest, there is considerable agitation afoot at the present time for the establishment of a stockpile terminal in Seattle which would be equipped for loading facilities for the shipment of these ores to foreign and domestic markets.

It is reported that heavy shipments of ore already are under way from Montana and Idaho and that plans call for this ore to be shipped to China and Japan by the Army in large tonnages in the next 4 yr.

It is estimated that the Seattle facilities could be expected to handle between 500,000 and 700,000 tons of various types of Northwest ores annually for the foreign market and that possibly approximately 200,000 tons would move out of here into the domestic market.

The principal shipments would probably be Montana and Idaho phosphate-manganese.

To Introduce Bill For British Steel Industry

London

• • • **Mr. Herbert Morrison,** Lord President of the Council, told the House of Commons recently that a bill would be introduced bringing the British iron and steel industry under public ownership. He made this announcement in answer to recent rumors that the government had on second thought abandoned its intention of taking the industry over. He denied that the industry had been left in a state of uncertainty, but felt that it was not appropriate for further details to be given until the bill was actually produced.

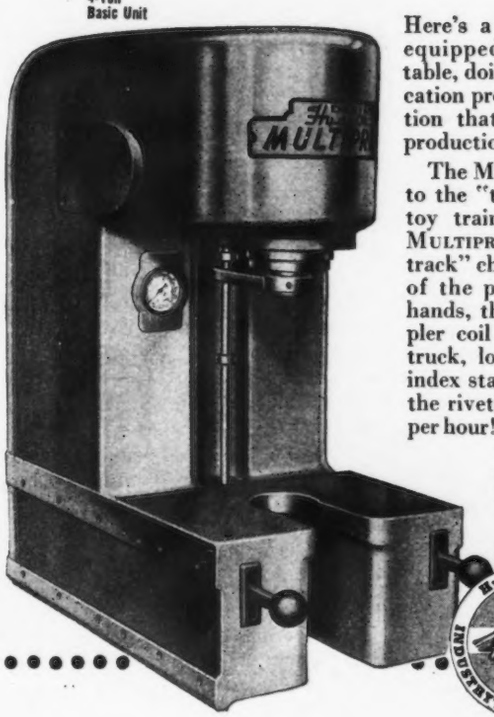
Mr. Morrison went on to say that the present steel shortage was due to factors beyond the control of either the government or the industry. Britain's home demand alone could be put at 16 million ingot tons a year, and total home production so far in 1946 was running at 12.7 million tons a year with sheet steel at the record prewar level.

Imports were unlikely to exceed half a million tons as the U. S. steel industry was also unable to cope with home demands. He assured the House that all possible help was being given by the government to the industry, including preferential treatment over coal, subsidies for use of marginal capacity and abnormal transport movements. Steel exports were down to rock bottom, and no steel was being exported unless failure to do so would affect the wider interests of the United Kingdom's economy.

Work Simplification...

...the MULTIPRESS *Way*

MULTIPRESS has key part in all-out work-simplification program at LIONEL Corporation



Here's a close-up of a MULTIPRESS, equipped with a HydrOILic index table, doing its part in a work-simplification program at the Lionel Corporation that lowered costs and *doubled* production.

The MULTIPRESS rivets coupler coils to the "trucks" of the famous Lionel toy trains. Trucks are fed to each MULTIPRESS operator on the "train-track" chutes coming in from the right of the picture. Working with both hands, the operator simply fits a coupler coil from a nearby bin to each truck, loads the assemblies onto the index stations—and MULTIPRESS does the riveting at the rate of a thousand per hour! A sweep arm and air jet whisk the riveted pieces off the index table onto the conveyor belt.

The quiet, oil-smooth accuracy of MULTIPRESS power is a "natural" for dozens of different operations—in any kind of production. And you can see in this instance how the streamlined compactness of this powerful little bench-size tool is an important advantage. The unit fits close to the conveyor belt, permits parts-supplying chutes of minimum length, and affords maximum room for conveyor equipment as well as for the operator.

MULTIPRESS is available in 4, 6, and 8-ton capacities, in both manually and automatically controlled models offering ram actions for every type of requirement. The HydrOILic Index Table is only one of a wide variety of standard attachments and tooling accessories that adapt the basic MULTIPRESS to many different needs. Write for data suggesting how this *new kind* of oil-hydraulic production tool can help you!

The Denison Engineering Company, 1158 Dublin Rd., Columbus 16, Ohio.

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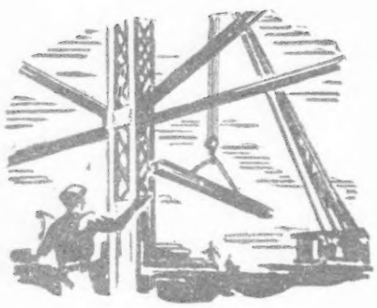
European Letter

JACK R. HIGHT

• British occupation authorities pursuing policy of stalling on dismantling German steel capacity despite Potsdam Agreement . . . Steel sheet shortage in England worries auto exporters.



LONDON — The astute delaying tactics being pursued by British occupation authorities in steelworks reparations are beginning to bear awkward fruit in the relationship of the military government with the German people. British policy has been noted before to recognize theoretically the need for dismantling a large amount of steel capacity, under the terms of the Potsdam Agreement to limit German war-making potential, while actually delaying all such dismantling as much as possible.

The accompanying list which gives the actual state of affairs was recently disclosed by military government officials at the request of a member of Parliament. Answering the question, obligatory to the government by British custom, was no doubt approached with considerable reluctance. I made exhaustive efforts to get just such a list out for most of the past summer, but it was described to me as an impossible task.

The policy for the operation of various works has been altered so frequently in the past year, and the motives for the policy changes have been so widely discredited that it can only be asserted now that British intentions are towards a single end, and almost any means will be utilized to achieve that end.

As has been so frequently noted, the British officials feel that to reduce the capacity of the Ruhr to 5,800,000 metric ingot tons capacity annually would be sheer folly, despite the fact that this folly is dictated under the terms of two existing Big Power agreements. Of the 18 million metric tons capacity remaining, the British still feel that any Germany that is to exist must use at least 10 million.

Although Britain signed on the dotted line in Berlin for the reductions, there is no longer any serious intention on the part of British administrators of carrying out actual deliveries of steel mills as reparations until some compromise settlement is reached on the future of Germany. Until such a compromise is achieved, the British will continue to stall on deliveries in every possible fashion, while avoiding any showdown statements such as Lt. Gen. Lucius Clay, deputy military governor of the American Zone, made for the U. S. to the effect that no more reparations would be delivered.

THE British Zone is once more preoccupied with an orgy of wailing over the food shortage. On the strength of the unification of the American and British Zones economically, the British Zone increased the basic ration level from 1050 calories per day to 1550, in line with the prevailing level in the American Zone. This was based entirely on the hope of increased assistance from the U. S. authorities in the way of shipments from America, as there was no exportable surplus of agricultural production in the American Zone.

According to the British Control Commission authorities here in London, the American authorities are to blame for the new "crisis" in food supplies. From the facts available here, it seems that the shipping strike in the American ports held up wheat shipments that should have made the November bread ration. From reports in the local press today, it seems that ships are now on the way which will avert an actual ration cut once more, although there has already been some substitution of sugar and potatoes for the bread ration this week.

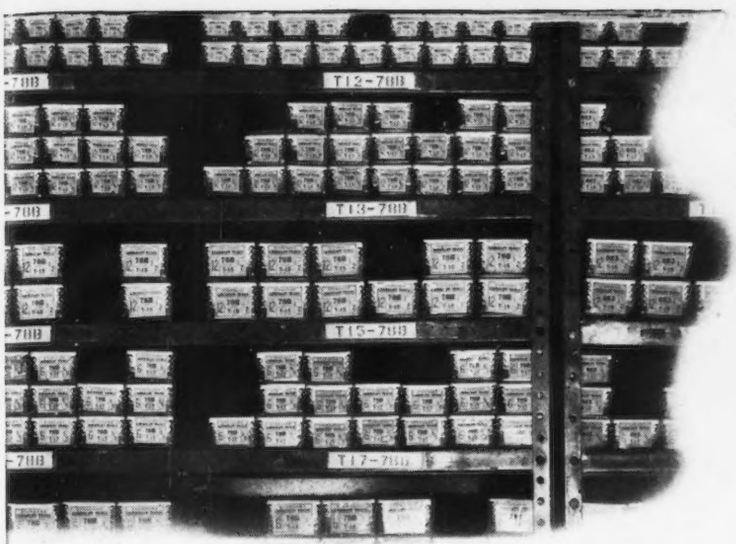
Whether or not the food crisis is staved off without a permanent ration cut once again, it seems likely that the outcry in the daily press will once again sharply reduce coal production in the Ruhr. This reaction is psychological; the miners themselves are now getting 4000 calories a day, and would certainly stand far above the average worker regardless of what cut was made. The anxiety for families and friends is expected by British administrators to reverse the upward trend of coal production that has been so laboriously achieved.

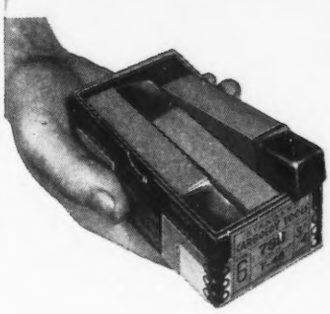
Daily coal production in the Ruhr had been averaging about 180,000 tons up to Oct. 15, when the last food increase was granted. Since then, output has gradually been stepped up to 188,000 tons per day, which has pleased coal officials, although their long-term plan for the year called for 195,000 tons per day this month and 200,000 next month.

THE shortage of steel in Britain has received somewhat less notoriety than its counterpart in America, but is just as real. The problem has existed since the end of the war, but in a less acute state as consuming industries were delayed by reconversion problems. Today as the major consuming industries are getting into full swing, the steel situation, particularly in sheets, is attracting national attention.

Part of the national concern which surrounds the postwar export program in the United Kingdom is centered on the British automotive industry, which has been exporting a large proportion of its production in the past year. The British automotive industry has established a high price level for its products, and is aware that in a world market which is saturated with lower priced American models it will have difficulty in maintaining its present rate of sales. It may be then that the present policy is to export as many units as possible while price is no object in any market, knowing that a high tariff wall is protecting the long unsatisfied home market until the British producers get around to it, a couple of years or so hence.

Whether such motives be ac-





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curate or not, the British automotive builders have learned that in obtaining allocations of any material from a government that is responsive to the public will, he who takes his wailing to the public wall and mixes it with the most self-righteous sobbing is apt to get the most response. This practice has been followed by the motor car industry here wherever possible.

The national shortage of manpower, especially skilled types, and more particularly the shortage of coal are combining to forecast cuts in steel production for the winter months. The result will be a cut to most consumers, at a time when the auto industry in particular claims to be in a position to greatly expand its consumption. The impending reduction of operations in the steel mills, and other coal consuming industries is no particular surprise, as competent observers have been noting for months that the coal supply situation has been gradually deteriorating. The auto industry is taking the pained attitude that it is being singled out for abuse by those who determine the sheet allocations.

STEEL PRODUCING PLANTS IN THE BRITISH ZONE OF GERMANY

Name and Location of Steel Works	(Thousand Metric Tons of Crude Steel) Peak Year Output During 1938-1944	Present Actual Rate of Production
D.H.H.V. Hoerde	1065	342
G.H.H. Oberhausen	1284	336
Klockner, Georgamarienhutte	336	96
Ilseder Hutte, Peine	662	198
Walzwerke Boking, Koln	81	30
Harkort-Eicken, Hagen	55	30
Press-u, Walzwerks, Dusseldorf	151	46
Ruhrstahl, Witten	175	40
Eisenhutten Werke, Bochum	147	86
Ruhrstahl, Oberkassel	59	2
Klockner, Haspe	759	126
D.R.W. Mulheim	223	60
Geisweider Eisenwerke	91	69
Krupp, Rheinhausen	1402	60
Bockumer Verein Gusstahlfabrik, Bochum	618	197
Hoesch, Dortmund	1323	228
Deutsche Edelstahlwerke, Krefeld	179	16
Deutsche Edelstahlwerke, Bochum	14	2
Bchler, Dusseldorf	45	1
Mannesmann, Huckingen	805	198
Thyssen Heiderich, Duisberg	900	342
Mannesmann, Gelsenkirchen	216	72
Thyssen Niederrheinische, Duisburg-Hockfeld	378	84
Miscellaneous Small Plants (69)	433	7
Thyssen-Ruhrort	546	Idle
Ruhrstahl, Gelsenkirchen	33	Idle
Krupp, Essen	260	*
Krupp, Essen-Borbeck	448	†
Bochumer Verein, Hontropm, Bochum	340	Idle
Reichswerke Hermann Goering, Watenstadt	850	Idle
Thyssenhutte, Hamborn-Duisburg	2332	Idle
Deutsche Edelstahlwerke, Linn	25	Idle
Deutsche Edelstahlwerke, Hannover	18	Idle
Ruhrstahl Annener, Witten-Annen	57	Idle
Mannesmann Grossenbaum, Grossenbaum	161	Idle
G.H.H. (Haniel & Lueg), Dusseldorf	64	*
Rheinmetall, Dusseldorf	130	Idle
Deutsche Eisenwerke, Mulheim	203	Idle
Bergische Stahlindustrie, Remsheid	36	Idle
Spandauer Stahlindustrie, Berlin	70	Idle
D.H.H.V. Werke Dortmund, Dortmund	983	Idle
Klockner Werk Osnabruck, Osnabruck	112	Idle
Ruhrstahl Henrichshutte, Hattingen	378	Idle
Klockner, Dusseldorf	99	Idle
Bochum Weitmar, Bochum	250	Idle

* Idle and allocated for the Western Allies as reparations.
† Idle and in process of being dismantled for the Russians in accordance with Inter-Allied Reparations Agency allocation.

LATE in 1945 the automobile industry was sounding a different plaint, then asserting that the high cost of steel was responsible for the high cost of British passenger cars. Although the steel industry soundly condemned this obviously heretical thinking, when the time came to increase steel prices at the first of the year, shouting apparently had its effect. In an otherwise across-the-board increase, autobody sheet was the only product which did not go up. Whether the latest wailing will be as effective remains to be seen but significantly the Ministry of Supply, which is the final authority on allocations, is studying the supply situation on sheets, and may revise the present distribution picture somewhat.

In the first half of the year, the shipment of finished steel products abroad was making up a substantial part of the total of British exports, and was one of the items increasing most rapidly. Now, with the local demand gradually increasing, the steel export program is decreasing, and may decrease much more, as the export of manufactured products from steel will swell the national export total even more than the shipment of the steel itself. On the other hand, the British steel industry will depend heavily in the postwar period on a percentage of export business, and the government may be expected to assist the industry in maintaining a sufficient level of exports.

U.K. Raises Copper, Zinc

London

• • • **In order to** bring the selling prices of scrap copper and zinc in the United Kingdom more closely into line with current purchase costs, the British Minister of Supply has increased the maximum prices at which these metals may be sold in the United Kingdom.

Copper by $56 per ton to $98, duty paid, delivered.

Zinc by $20 per ton to $220, duty paid, delivered.

Zinc sheets by $20 per ton to $264.50, duty paid, delivered ex works.

Zinc oxide by $17 per ton to $224, duty paid, delivered.

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PERSONALS

o o o

• **W. E. Griffiths** has been elected president of American Alloy, Inc., Chicago. Mr. Griffiths, formerly assistant manager of the flat-rolled steel sales division of Allegheny Ludlum Steel Corp., Brackenridge, Pa., will head the new warehouse organization which will handle stainless steel products and other alloy steel specialties. **Paul C. Sandmeyer** has been appointed manager of the new warehouse of American Alloy, Inc., Chicago. Mr. Sandmeyer was formerly manager, stainless steel division, Jessop Steel Co., Washington, Pa. He was also formerly associated with Carnegie-Illinois Steel Corp.

• **William Lotter** has been appointed assistant to A. H. Brodbeck, director of research of the American Stove Co., Cleveland, and will be in charge of research development of Magic Chef heavy duty cooking equipment. Mr. Lotter was formerly chief engineer of the Cleveland division of the American Stove Co.

• **Joseph W. Eskridge** has been named factory manager of Hudson Motor Car Co., Detroit. Mr. Eskridge has been associated with Hudson for 20 yr and has recently been in charge of Hudson's car-building program.

• **R. E. Griffin,** formerly production manager, has been appointed executive assistant to S. E. Skinner, general manager of the Oldsmobile Div. and vice-president of General Motors Corp., Detroit. Mr. Griffin has been with Oldsmobile for more than 30 yr and was named works manager in 1941. **T. C. Downey,** for the past 18 months assistant manufacturing manager, has been named Oldsmobile production manager. He previously held key positions in the manufacturing departments of Chevrolet Div. of GM.

• **W. E. Gilbert** has been appointed to the sales department as manager of the processing equipment division of the Detrex Corp., Detroit. Mr. Gilbert joined Detrex in February 1939, and was soon promoted to factory superintendent of the drycleaning division. In 1941 he was appointed plant superintendent in charge of all equipment fabrication, a position which he held until his recent transfer to the sales department.

• **Stanley A. Sanford** has been appointed supervisor of raw materials for American Steel & Wire Co., Cleveland. Mr. Sanford was associated for 10 yr with the Barrett Co. as manager of manufacturing, and then with the Climax Refining Co. as vice-president, until his election in 1932 as president of Steel Engineering & Equipment Corp. He joined American Steel & Wire Co. in 1943 as metallurgist and research chemist, and recently was named assistant supervisor of raw materials.

• **W. C. Snyder, Jr.** has resigned his position as president and director of the Continental Foundry & Machine Co., Pittsburgh.

• **Torsten H. Parke** has been appointed to the sales department of the Scullin Steel Co. He will be in charge of the New York office, succeeding the late Brownrigg L. Norton.

• **Lee Mullen** has been appointed general manager of sales of Globe Steel Tubes Co., Milwaukee. Mr. Mullen has been with Globe Steel Tubes since 1943, and was formerly with Sharon Steel Co., Republic Steel Corp., and Pittsburgh Steel Co.

LEE MULLEN, general manager of sales, Globe Steel Tubes Co.

• **Howard M. Daschbach,** traffic manager for the Geneva Steel Co., has been appointed to the same position for Columbia Steel Co. and will serve both of these U. S. Steel Corp. subsidiaries. Mr. Daschbach entered the employment of the corporation with the American Steel & Wire Co. at Pittsburgh as a routing clerk.

• **Robert H. Baugh** will supervise the new Monsanto Chemical sales office which will be opened Dec. 1 in Cleveland. Mr. Baugh will handle the phosphate division sales in the area. **T. C. Tupper** will represent the company's organic chemicals division, while **R. T. Clark** will handle the Merrimac Div.

• **Morton F. Harvey** has been appointed manager of the new factory sales office of Formica Insulation Co. to be opened in Dallas the first of the year. Mr. Harvey has been associated with the Chicago sales office for more than 20 yr.

• **Norman M. Ramler** has been named district sales manager of the recently opened Chicago office of Warco Sales Co. Assisting Mr. Ramler as sales engineers are **Gilbert R. Krug** and **Cecil E. Novinger.** Warco represents the Warren City Mfg. Co., a subsidiary of Federal Machine & Welder Co., Warren, Ohio.

• **George M. Humphrey** has been elected chairman of Pittsburgh Consolidation Coal Co., to succeed **Robert C. Hill.** Mr. Humphrey has been president since 1929 of the M. A. Hanna Co. Mr. Hill retired as active chairman of the Pittsburgh Consolidation Coal Co., ending 53 yr of service in the coal industry. He will continue as director and honorary chairman.

• **Murray C. Scott,** of the Pittsburgh service engineering staff of Hall Laboratories, has been assigned to the West Virginia office at Huntington, aiding J. T. Waldron, who has been handling sales and service in that territory for 2 yr. **J. Mylan Harvey** has been transferred from the Pittsburgh service staff to the Cleveland field service staff. Mr. Harvey, as a service engineer, since 1939, has handled water conditioning under Hall system for Pittsburgh district steel plants, as well as the Koppers synthetic rubber plant at Kobuta, Pa.

PERSONALS

• **Harry Dallas** has been named resident engineering manager by Ellinwood Industries to represent the firm in farm equipment and engines, aircraft, marine, and electronic sales in the Seattle area.

• **D. G. Kimball** has been appointed engineer of the General Electric Co.'s wiring device and accessory equipment division, Bridgeport, Conn. Mr. Kimball's first position, when he joined the company in 1930, was in the drafting section of the wiring device division. He has also been connected with the heating device engineering division.

• **Raymond M. Page** has been appointed manager of distributor sales of the Fafnir Bearing Co. of New Britain, Conn. He succeeds the late Stanley M. Prior. Mr. Page joined the company in 1929 after having been connected with the sales departments of Ross Gear & Tool Co. and the Roller Bearing Co. of America. For some time he has served as assistant manager of distributor sales of Fafnir Bearing Co.

• **Marvin Anderson** has been appointed to the Moline, Ill. office of the Lincoln Electric Co. of Cleveland. **Albert Bavaria** has been appointed to the Philadelphia office; **Richard Freundlich,** the Cleveland sales office; **Paul Holden,** the Franklin, Pa. sales office; **Richard Nelson,** the Syracuse office; **Richard K. Reynolds,** the Detroit office; and **John E. Williams** has been appointed to the Syracuse, N. Y. office.

• **L. H. Billings** has been appointed district manager of a newly created Falk Corp. sales territory. Formerly production manager at Falk, he directs sales in Wisconsin, upper Michigan and parts of Iowa. **B. C. Bugbee** has been named production control manager. Associated with the company for the past 5 yr, Mr. Bugbee was a member of the plant engineering department until 1944 when he became assistant to the works manager.

• **Robert R. Wallace,** superintendent of industrial relations for the American Steel & Wire Co., Worcester, Mass. South Works, will retire Nov. 30 after 35 yr with the company.

H. J. LEISENHEIMER, director of export sales, Hydraulic Press Mfg. Co.

• **H. J. Leisenheimer** has been appointed director of export sales of the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. Mr. Leisenheimer was formerly associated with the Cleveland Tractor Co. as executive vice-president.

• **Edwin S. Webster,** co-founder of Stone & Webster, Inc., Boston, has retired as chairman of the board and will be succeeded by **William T. Crawford,** who for the past 10 yr has been executive vice-president. Mr. Webster will continue his directorship.

• **Ivan C. Alspach** has returned to Akron, Ohio, as manager of mechanical goods for Goodyear Tire & Rubber Export Co. Since 1944 he has been the company's mechanical goods representative for the Atlantic seaboard, with headquarters in New York. Succeeding Mr. Alspach in New York is **William H. Klippert,** a member of the company's mechanical goods sales staff since 1944. Mr. Alspach joined Goodyear in Akron as a tire builder in 1927. Later he transferred to the accounting division, and in 1934 he was made sales manager of Goodyear's subsidiary, the Wheeling Township Coal Co., Adena, Ohio. He joined Goodyear Export Co. in 1944.

• **Gorton M. Evans** has been appointed purchasing agent of Pioneer Engineering & Mfg. Co., Detroit. He worked in the purchasing department of the Detroit Gear Div., Borg Warner Corp. for 8 yr. He went to Chrysler Corp. for 3 yr and then returned to Borg Warner. **Robert L. Crinnian** has been named assistant chief engineer of Pioneer. Mr. Crinnian is a founder and past president of the American Society of Industrial Engineers. At present he is chairman of its board of directors.

• **Bryant H. Gardner** has joined the Chemical Corp. of Springfield, Mass., in the newly created post of advertising and sales promotion manager. Mr. Gardner came from Wm. B. Remington, Inc., where he was an account executive. Prior to this he spent 14 yr in the radio and advertising fields.

• **Dr. C. F. Goodrich,** chief engineer, American Bridge Co., Pittsburgh, retires Dec. 1 after 40 yr of service with this U. S. Steel subsidiary. Dr. Goodrich has held various positions in the company's engineering department prior to his appointment as chief engineer in 1935.

• **Maurice O'Grady** has been elected acting president of the American Steel Export Co., Inc., New York. He has served as an officer of the company since its inception in 1922 and until his new appointment was vice-president and treasurer.

• **Lloyd L. Lee,** formerly vice-president in charge of sales and engineering at Plan-O-Mill Corp., has resigned from Plan-O-Mill to accept a position with Frederick Colman & Sons, Inc., in their machine tool division in Detroit.

• **Howard Hansen** has been named supervisor of the office of J. L. Singleton, manager of district offices of the Allis-Chalmers Mfg. Co., Milwaukee. Mr. Hansen joined Allis-Chalmers in 1941 and since that time has worked in the works accounting department, blower and compressor department and in the administrative office of William C. Johnson, vice-president of the firm's general machinery division.

• **Eugene N. Foss, II,** has been appointed manager of the northwestern district of B. F. Sturtevant Co. Div. of Westinghouse Electric Corp., succeeding **Fred Herlan,** who will retire soon. In his new position Mr. Foss, who will have his headquarters in Chicago, will direct sale of Sturtevant air handling and air conditioning equipment in northern Illinois and Indiana, western Ohio, parts of Michigan, South Dakota and Montana, and all of Wisconsin, Iowa, Minnesota, Nebraska and North Dakota. The new district manager joined Sturtevant at Hyde Park, Mass., in 1934.

• **Russell L. Findley** has been appointed manager of the Cincinnati office of Westinghouse Electric Corp.'s engineering and service department. Mr. Findley has been with the company for 23 yr, most recently as consulting and application engineer.

• **Arthur S. Klopf** has been appointed works manager of the Western Foundry Co., Chicago, where he will have charge of the Chicago, Holland, Mich., and Morris, Ill. plants. Mr. Klopf, formerly senior engineer with Lester B. Knight & Associates, Inc., began his industrial experience at the Worthington Pump & Machinery Corp., later being associated with the Allis-Chalmers Mfg. Co., Ross-Meehan Foundry Co., Kearney & Trecker Corp. and the Hansell-Elcock Co.

JAMES J. NANCE, executive vice-president and director, Edison General Electric Appliance Co.

• **James J. Nance** has been elected executive vice-president and a director of the Edison General Electric Appliance Co., Chicago. Prior to his present appointment, he had been serving on the staff of Charles E. Wilson, president of the General Electric Co. For many years he was associated with the frigidaire division of General Motors Corp. and he has also held marketing and administrative positions with Zenith Radio and Easy Washing Machines.

• **John E. Gobeille** has been appointed sales manager for the Metal Products Co., Milwaukee.

• **E. A. Bertram** has been appointed manager of the industrial division, the National Radiator Co., Johnstown, Pa. He was formerly in charge of the company's New York industrial sales division. Prior to his affiliation with the National Radiator Co., Mr. Bertram was associated with the Lummus Co. as chief engineer of the heat exchange division and was general manager of the Heat Transfer Products Co.

• **Delmar E. Baker** has been added to the staff of application engineers of Kennametal Inc., operating out of Kennametal's midwestern district headquarters office at Chicago; **William L. Chambers** and **Richard H. Oberholtzer** are located at the central district headquarters office, Detroit; and **Leo J. Perrette** is operating in the Cincinnati-Indianapolis area, and located at Kennametal's Cincinnati office. **Robert S. Sagers** has been appointed a representative in the Philadelphia area of the middle Atlantic district. **Allen M. Austin** has been made an agent in the Kansas City area with headquarters at Chicago, and **Harry W. Bearfoot** has been appointed a representative in the Baltimore area with headquarters at Philadelphia.

• **Albert A. Mattson** has been appointed supervisor of traffic and **James F. Haley,** supervisor of transportation, for Koppers Co., Inc., Pittsburgh.

...OBITUARY...

• **A. F. Rice,** manager of western region appliance sales for Rheem Mfg. Co., New York, died in the crash of an airliner Nov. 13.

• **John W. Garvey,** 60, engineer and draftsman for the Bell Aircraft Corp., Buffalo, for the last 5 yr, died Nov. 14.

• **R. E. Post,** veteran representative of Fairbanks, Morse & Co., who has for the past decade been manager of the firm's Washington office, died after a month's illness on Nov. 13.

• **Dr. Sanford A. Moss,** 74, consulting engineer in the aircraft gas turbine division of the General Electric Co.'s River Works, Lynn, Mass., died suddenly of a heart attack on Nov. 10.

• **Frederick W. Brehmer,** 66, founder and president of the F. W. Brehmer Machine & Tool Co., Cincinnati, died recently.

• **Thomas H. Adams, Jr.,** 42, production engineer at Bethlehem Steel Co.'s Quincy, Mass. yard, was killed Nov. 10 while deer hunting.

• **John J. Kane,** 63, general patent attorney for the Allis-Chalmers Mfg. Co., Milwaukee, died Nov. 8 after a long illness. He had been with the company since 1912 and in 1944 was made head of the patent department.

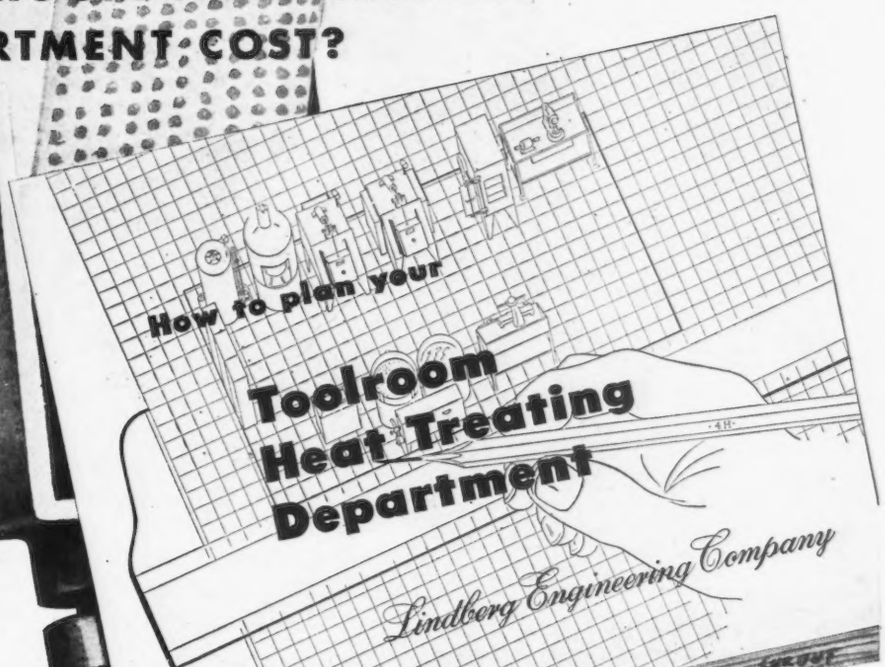
• **Dr. Paul F. Cadman,** 57, adviser to Henry J. Kaiser since 1944, died Nov. 11 of a heart attack following several months' illness which had made it necessary for him to take a leave of absence from his Oakland, Calif. offices.

• **Herman C. Nelson,** district sales manager for Bliss & Laughlin, Inc., of Harvey, Ill., died suddenly Nov. 3. He had been associated with the firm for 12 yr.

• **W. J. Phillips,** 56, who had been a salesman for the Pittsburgh warehouse of the Jones & Laughlin Steel Corp. for 25 yr, died recently. Mr. Phillips started with J&L at its Pittsburgh works in 1911 and in 1921 transferred to the warehouse sales division.

The $64. question...

HOW MUCH WILL A COMPLETE TOOLROOM HEAT TREATING DEPARTMENT COST?



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How do you get your copy? Write to your nearest Lindberg Engineering Company office, or to the Lindberg home office at 2452 West Hubbard St., Chicago 12, Illinois.

LINDBERG FURNACES

Dear Editor:

WIRE STRETCHERS

Sir:

We would very much like to secure wire lengthening machines, new, rebuilt or used, and ask you to please submit us names of manufacturers. . . . Also would like to hear from construction, agricultural and industrial machinery manufacturers in the States who are willing to do business with us.

CESAR M. GUTIERREZ, JR.
Manager
C. M. Gutierrez y Hno.
Monterrey, N. L., Mexico

● Your query had us puzzled at first, reader Gutierrez, but we checked and located a half dozen makers of wire lengthening machines and are forwarding this list.—Ed.

MOLYBDENUM, NOT CHROMIUM

Sir:

We note in the Sept. 19 issue on "Newsfront," reference to a new patented process for plating chromium and nickel simultaneously on carbon steel. Can you give us either the U. S. Patent number and Patentee or the company who is sponsoring this process?

O. E. ROMIG
Assistant Research Engineer
Carnegie-Illinois Steel Corp.
Pittsburgh

● The item should have read "nickel and molybdenum," instead of nickel and chromium. More information may be obtained by writing to Dr. Chester, Walker Mfg. Co., Jackson, Mich.—Ed.

REQUEST FROM INDIA

Sir:

We shall be grateful if you will kindly inform us the addresses of manufacturers of steel, special Z, T, U, L and other small sections, required for the manufacture of steel doors, windows, casements, etc. We would like to know the prices of these sections and the time of delivery. Can we get stainless steel sheets, and what are their sizes and the prices?

V. R. RANADE & SONS, LTD.
Poona, India

● An extensive list of small section producers is being forwarded to you. It is not possible to give you complete prices, lacking information on extras that might apply; as for deliveries, your guess is as good as ours. Suggest you check the weekly market reports closely for latest information on the delivery situation. We are also sending a list of stainless steel producers.—Ed.

SOAP MANUFACTURE

Sir:

We would appreciate some information regarding the soap making business including washing powder. We wish to establish a business of this kind and want to know where we can buy the necessary machinery and equipment. Also, where can we get authoritative books on the subject?

J. T. McDONALD
Manager
Oil Center Foundry & Pattern Works
Longview, Tex.

● We are forwarding lists of publications and names of concerns manufacturing soap making machinery.—Ed.

VACUUM MELTING

Sir:

Kindly send us tear sheets or photostatic copies of the article which appeared on p. 67 of the June 27 issue entitled "Vacuum Melting."

G. V. CORBETT
Advertising Manager
Driver-Harris Co.
Harrison, N. J.

● The item Reader Corbett refers to describes a report of German practice in vacuum melting, available only from the Office of Technical Services, Dept. of Commerce, Washington.—Ed.

TOOL STEEL DIRECTORY

Sir:

Please send me three copies of your "Directory of Tool Steels" . . .

J. W. FINDLATER
Ajax Steel & Forge Co.
Detroit

Sir:

Please send us five copies of "Directory of Tool Steels."

C. W. DAVIS
Davis Tool & Engineering Co.
Detroit

● The new and revised edition of THE IRON AGE "Directory of Tool Steels," which covers tool, metal-cutting and die steels, and sintered carbides, is available at the following prices: $1 for a single copy, $1.50 for two copies, $2 for three copies, and 50¢ each for five or more copies.—Ed.

SPARES FOR AUTOMATICS

Sir:

I require equipment and spares for a 5-spindle Davenport Automatic. Could you give me the name of a firm who may be able to supply same?

H. G. BASSETT
American Metal Crafts Co.
Attleboro, Mass.

● Suggest you write the manufacturer, Davenport Machine Tool Co., Inc., Box 228, Rochester, N. Y.—Ed.

CONTROLLED ATMOSPHERES

Sir:

If you have made reprints of "A Critical Survey of Controlled Atmospheres" by E. J. Funk, Jr. and D. von Ludwig, in the Sept. 19, 26 and Oct. 3 issues, we would like to get one. We do not like to tear the sheets from our copies as we keep them on file for general reference.

D. A. COTTON
Master Mechanic's Office
Delco-Remy Div.
General Motors Corp.
Anderson, Ind.

PERMANENT MOLD CASTINGS

Sir:

I would appreciate receiving th article, "Aluminum Permanent Mol Castings," appearing in the issue o April 23, 1942. If you are unable t supply me with the article, perhap you can tell me where I could obtai it.

H. E. BOURASSA
Permanent Mold Sup
Castalloy Co., Inc.
Cambridge, Mass.

● Our supply of the Apr. 23, 1942, issue i exhausted. However, there is a back num ber magazine dealer, H. W. Wilson Co 960 University Ave., New York 52, fro whom we believe you can obtain the abov copy. Old issues cost about 50¢ each.—Ed

PREFABRICATED WAREHOUSES

Sir:

We want contact with several small but good, steel prefabricators wh could produce steel warehouses for u approximately 32 x 98 x 12 ft. Loca tion is not important as we place thes warehouses all over the country.

A. J. HOFMANN
A. J. Hofmann Co.
Narberth, Pa.

● List of companies has been sent.—Ed.

IRON-COPPER POWDERS

Sir:

Please send me two sets of tea sheets of F. C. Kelley's article, "Prop erties of Sintered Iron-Copper Pow ders," which appeared in the Aug. 1 issue.

G. STEVENSON
Chief Design Enginee
F. J. Stokes Machine Co.
Philadelphia 20

SWEDISH STEELS

Sir:

We would appreciate receiving a re print of the article, "Sweden Develops Specialized Steels for Foreign Markets," by Hans G. Tonndorf in the June 6 issue.

H. BELL
Director of Rehabilitation an Occupational Therapy
Aldercrest Sanatorium
Snohomish, Wash.

● We did not reprint the article on Swedish specialized steels. However, we are pleased to forward you tear sheets.—Ed.

COMPARABLE STEEL ELECTRODES

Sir:

May we have two reprints of pp 139-140 of the Jan. 3 copy of your magazine. If possible we would like to have these tables, "Comparable Arc Welding Electrodes for Steel" and "Comparable Stainless Steel Electrodes," in the form in which they appeared in the magazine.

E. T. EVANS
Cornell Aeronautical Laboratory
Buffalo 5

● Reprints have been mailed. Copies are available at 20¢ per copy.

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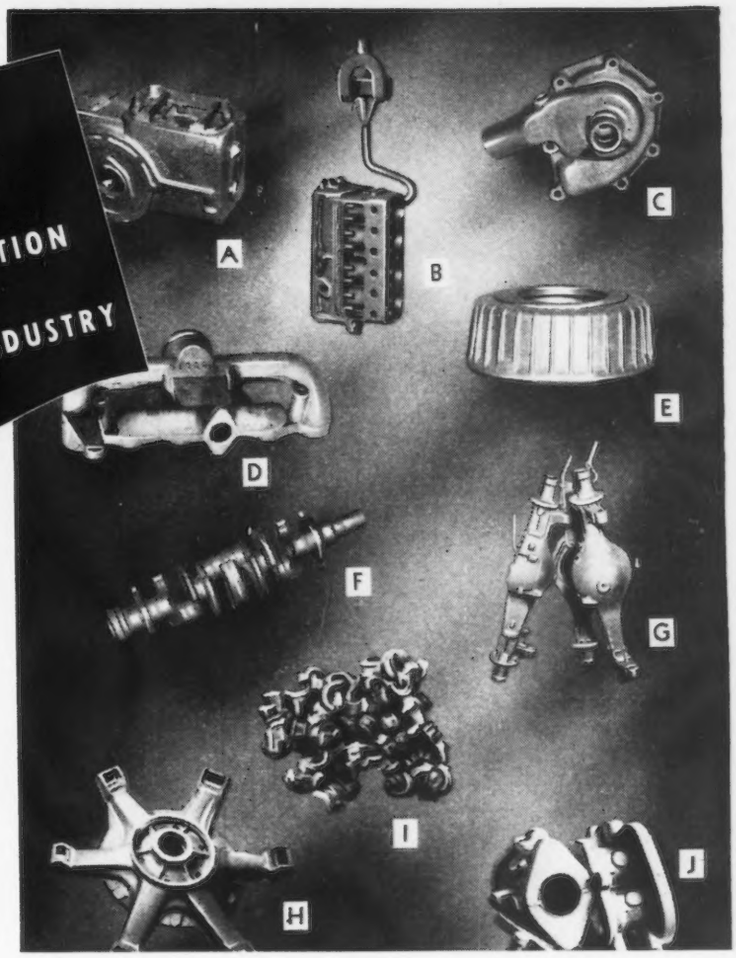
PROVED IN AUTOMOTIVE INDUSTRY



Today more automotive castings . . . in tonnage and variety of types and sizes . . . are cleaned by the airless Wheelabrator than by any other method.

In an industry such as this where *production* must be perfectly synchronized . . . where *quality* of every operation must match rigid standards . . . where *unit-cost* reduction is a watchword . . . only the most efficient production equipment can survive the acid test of practical economics.

Significant, therefore, is the wide general use of the Wheelabrator in this highly competitive industry. *Performance* is the gauge by which it has been measured and proved. To outsell it had to outperform. And it is on that convincing basis that we urge you to investigate it. Ask for a demonstration . . . or write for further information.

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Campbell, Wyant & Cannon
Packard Motor Car Co.
Centrifugal Fusing Co.
Elec. Auto-Lite Co.
Kelsey-Hayes Wheel Co.
Thompson Prod., Inc.
Caterpillar Trac. Co.
Briggs & Stratton Corp.
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(E) BRAKE DRUMS: Production increased 411% per hour using Wheelabrator Tumblast.

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(I) BEARING CAPS: 1800 pound loads of connecting rod bearing caps are cleaned in 8 minutes.

(J) CARBURETORS: Reduced breakage from 20% to practically nothing. Cleaning time 3 minutes.

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WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

Industrial News Summary . . .

- **Steel Loss Tops 400,000 Tons in Week**
- **Operating Rate Falls 22.5 Points to 68 Pct**
- **Long Coal Strike Will Cripple Fabricators**

IN the first week of the coal strike John L. Lewis had deprived American industry of more than 400,000 tons of steel as the coal crisis sent the steel ingot operating rate down 22.5 points to a figure of 68 pct of rated capacity, from last week's revised rate of 90.5. Steel mills, which had been operating at peak peacetime levels have small coal stockpiles on hand compared to their position during the last coal walkout when some were able to run full blast for the duration of the strike. Hence the effect of this coal strike is far more serious and immediate.

Perhaps more serious than the immediate effect of the loss of steel production and wages is the long-range effect on fabricators' inventories. Latest government data show manufacturers' inventories at a new high. One prime factor in this figure is the shortage of critical steel items, which has been holding millions of dollars' worth of goods off the market.

Steel sources see the present interruption as a further blow to a patient who had just passed his crisis and appeared well on the road to recovery. Steelmakers had just begun to bring some order out of chaos represented by tremendous and top-heavy backlogs; they had persuaded their customers that by cutting these backlogs they were in a fair way to scheduling deliveries on a reasonable basis. Now this careful planning has been upset and in its place has been substituted further uncertainty.

SOME steel companies began the job of cutting back operations on Monday, though some of the smaller firms planned to hold operations at prestrike levels for the balance of the week. Led off by a drop of 59 points in the Pittsburgh district, where Carnegie-Illinois Steel Corp. cut back to 35 pct of rated capacity, the national operating rate began a downward spiral which will soon hit metalworking plants throughout the country. Within two weeks, it is estimated that fabricating operations will be cut to about 50 pct, and some sources predict that many of them will be out cold within a month, if the strike continues that long.

Even the most confirmed optimists in the automobile industry are willing to concede that a prolonged tieup in the coal industry will have a devastating effect on the December motor car and truck output. While coal stocks in Detroit are generally not critically short, General Motors has reported that it has only a 24-hr supply of steel on hand. Ford, Packard and Hudson are only slightly better off, though Chrysler and Kaiser-Frazer indicate that sufficient supplies are on hand to permit operations for some time, though at reduced schedules.

Hanging like a sword over all industry is the threat of a nationwide freight embargo, which many railroad men predict will come this week. Such action would bring industry to a virtual halt. Usually, the reserve banks of coal have permitted a gradual shutdown of blast furnaces and steel mills with decreased shipments possible for weeks after the strike is called. This time no substantial coal stocks are available to industry and the cutbacks have come more sharply.

Many producers are not forgetting the fact that they will come up against Philip Murray's steelworkers union before present contracts expire in February. For this reason some steel sources believe that if the coal strike is a protracted one many furnaces which have now been banked and set to fanning will not be started up again until the outcome of the negotiations with the USWA-CIO is known. They repeat a well-known axiom of steelmaking that it is relatively easy to shut down a steel mill compared to the task of getting it back into full production. One thing appears certain—if the strike lasts a month Mr. Murray's argument on bloated corporated profits will blow up in his face.

Steel companies, through the breather the coal strike may afford, will continue a study of their price structures. The inequalities of price to cost on many steel items will undoubtedly be first corrected through a general revision of extras. Then, if costs due to the coal and steel strike require it, further changes will be made later.

SO far this week only one pig iron producer reported a price rise. Others have stated that they plan no immediate increase until settlement of the coal strike permits them to figure their costs.

Foundrymen, who have been experiencing terrific difficulty in obtaining sufficient pig iron to maintain operations, have been getting slightly larger supplies of iron scrap in the past few weeks. Cast scrap has risen proportionally more than openhearth grades and the higher prices have brought more out. Even higher cast scrap prices are predicted in some quarters as pig iron grows increasingly short.

The nonferrous field was highlighted by two significant price increases. The International Nickel Co. announced a contract price increase of 3½¢ per lb, effective Nov. 25, to 35¢ for electrolytic nickel, the first price change in nickel since 1925. Copper moved up 2¢ last week to 19½¢, compared to an OPA ceiling price of 14.375¢ per lb.

• **REVERSES POLICY**—One large steel producer who had decided, along with the rest of the industry, to request cancellations of 1946 backlogs, has decided not to do so. Although in agreement that such practice was entirely logical and in the best interests of everyone concerned, the plan was dropped in favor of meeting all 1946 firm commitments first and planning 1947 quotas after working off the backlog. This company will accept such cancellations but policy makers have insisted that the consumer must initiate such action without duress by the producing organization.

• **AUTO WAGE TALKS**—UAW-CIO has started wage negotiations with three automobile producers. Discussions with Chrysler, broken off during the week of October 18, are being resumed following the Atlantic City CIO Convention. Negotiations with Packard and Kaiser-Frazer have also been started. In the case of K-F it is understood that the demands include "substantial increases" as well as the establishment of a pension plan for employees having 25 yr seniority.

• **MOTOR PAYROLLS UP**—Bureau of Labor statistics show that the automobile body and parts plants are paying out nearly $36 million weekly to 699,000 hourly rated workers. This is an increase of 76 pct in dollar payments and 25 pct in the number of workers over 1941. Production cutbacks between Sept. 15 and Oct. 15 cost 18,500 Detroit workers their jobs but this loss was partially offset by an increase of 11,400 workers in other establishments.

• **$1000 REWARD**—In an effort to discourage the throwing of cans and bottles of paint at homes of Allis-Chalmers employees, the company recently ran 6-column newspaper advertisements offering to pay a reward of $1000 in cash for information leading to the arrest and conviction of the vandals.

• **BRITISH STEEL OUTPUT**—Steel production in the United Kingdom during October totaled 1,139,200 tons, compared with 1,089,500 tons in October 1945. Pig iron output for October also showed an increase, with production totaling 697,900 tons compared with 654,500 for the same month last year.

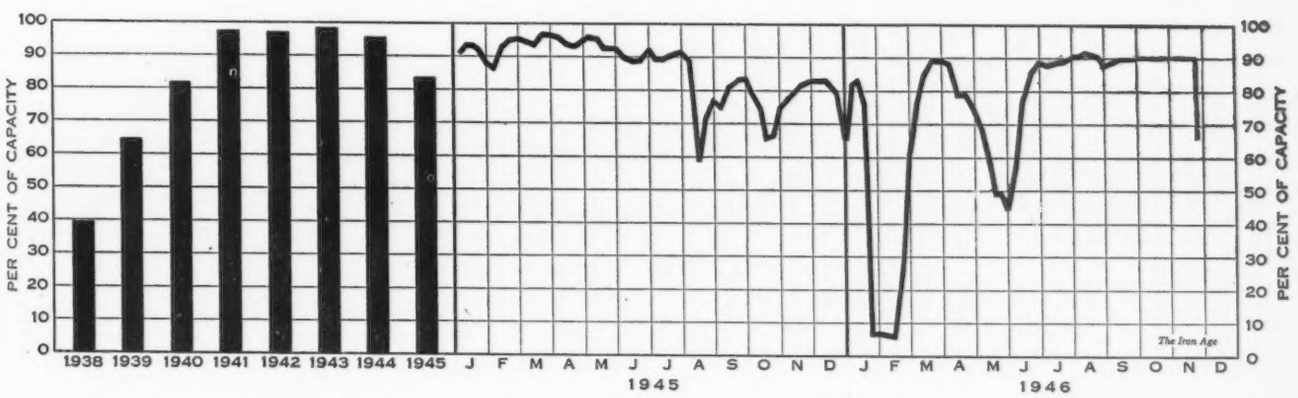
• **TO BID AGAIN**—New bids for the purchase or lease of the Government's $92 million steel plant in South Chicago, Ill., will be opened by WAA on Dec. 5. The Republic Steel Corp., war-time operator, now occupies the plant under interim lease, and on two occasions, has submitted bids along with three other bidders, in the plant. Republic offered to lease the plant for a $200,000 minimum annual rental based on production with option for renewal after 5 yr. Kaiser-Frazer offered to lease the plant. Cash offers ranging from $17,500,000 to $28,350,000 were made by other bidders.

• **NAIL SHIPMENTS**—If uninterrupted, the current high rate of nail shipments should in a few months relieve the shortage of this product, especially for the housing program, according to the American Iron & Steel Institute. During September nail shipments were equivalent to the highest peacetime annual rate since 1923, when 789,000 tons of nails were shipped. The total for September at 59,875 tons represents an annual rate of shipments at approximately 720,000 tons. The industry shipped 423,284 tons of nails during the first 9 months of 1946, as compared with 450,038 tons shipped during the similar interval of 1940, and 449,074 tons for the first 9 months of 1945. Under a recent order, the government is setting aside one-half of the weight of each shipment of housing-type nails received by suppliers to fill rated orders largely for the Veterans' Emergency Housing Program.

• **BRITISH LABOR FIGURES**—For the first time in 7 yr the number of workers engaged in manufacture for the British home market has exceeded the mid-1939 figure of 4,680,000. Employment statistics show that in August last 4,885,000 workers were producing goods not intended for export. People employed on manufacture for export in August numbered 1,375,000 compared with 990,000 at mid-1939. The total working population in August last was estimated at 20,102,000, showing an increase of 352,000 on the mid-1939 figure.

• **ASLEEP ON THE DEEP**—Carnegie-Illinois Steel Corp. who recently secured 28 discarded Pullman cars for sleeping quarters for workmen at the Gary plant are now trying to obtain Lake steamers for the same purpose for use this winter. Representatives of the company are looking for a few boats that they can moor in the slips at the Gary and South Chicago plants.

Steel Ingot Production by Districts and Per Cent of Capacity



Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
November 19...	99.0	91.5*	88.0	85.5	91.5	90.0*	96.0	97.0	102.5	78.0	99.0	78.0	89.0	90.5*
November 26...	40.0	75.5	62.0	60.0	94.0	67.0	84.0	99.0	103.5	77.0	99.0	60.0	88.0	68.0

* Revised.

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TURNER SYSTEM
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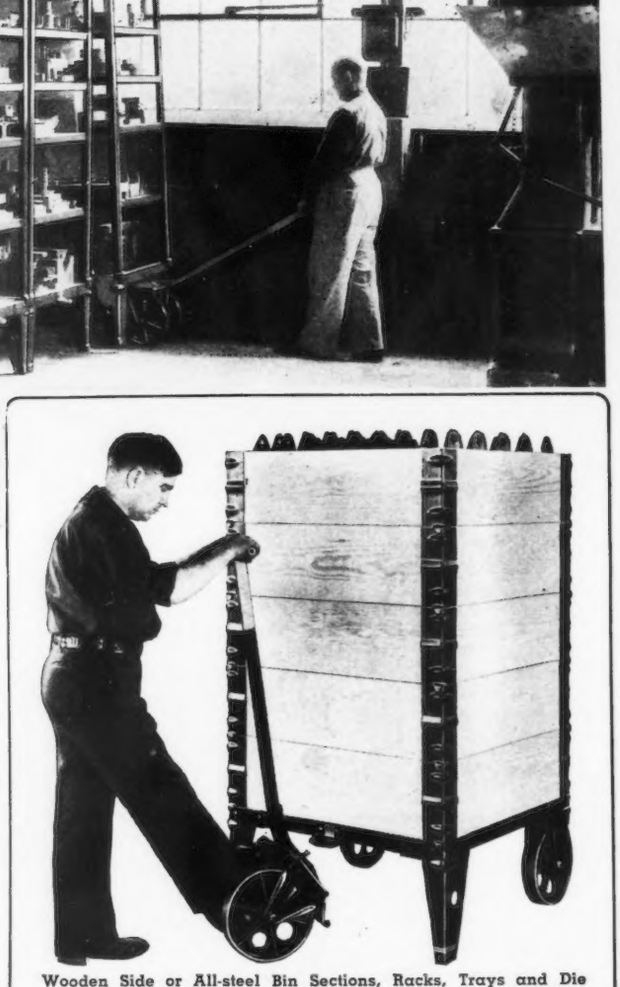
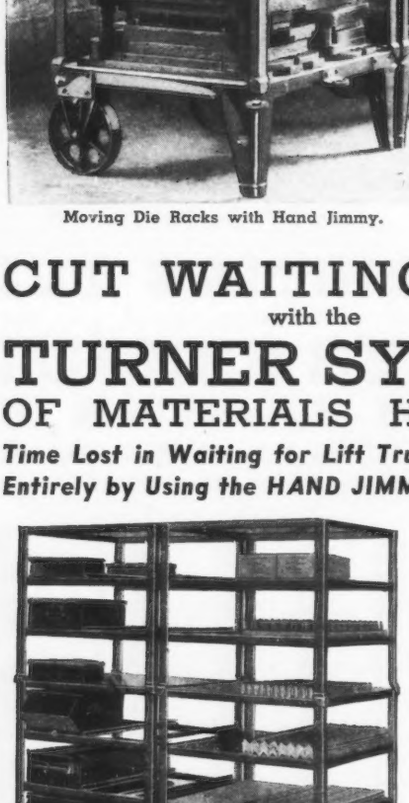


Wooden Side or All-steel Bin Sections, Racks, Trays and Die Tables fit on the Turner Transport which is moved by hand "Jimmy," power lift truck, crane or tractor.



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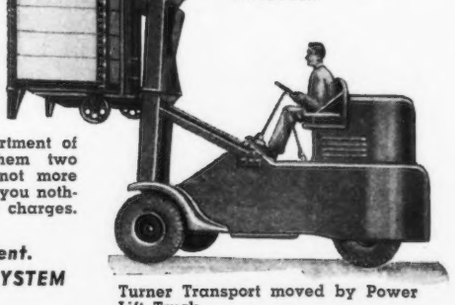

Turner Transport moved by Power Lift Truck.

FACTORY SERVICE COMPANY

4621 NORTH TWENTY-FIRST STREET — MILWAUKEE 9, WISCONSIN

Coal Crisis Brings Gloomy Outlook; May Set New Wage Pattern

New York

• • • **The temporary feeling** that labor-management relations would take a turn for the better with price and wage controls gone has for the time being at least been replaced by one of the gloomiest outlooks possible, as the result of the bitter coal crisis. Steel officials privately look for a prolonged tieup as John L. Lewis and the government slug it out.

According to some leading coal sources about the only out Mr. Lewis has from his present dilemma would be to quickly make a deal with the coal operators. High sources in coal quarters see Mr. Lewis and the government as "through with each other." But whether the UMW chief and the coal operators could come to an agreement quickly enough to forestall what is now said to look like one of the most serious strikes in labor history remains to be seen—with the odds against it.

In the background there looms the possible loss of many millions of tons of steel over the next several months if the steel wage negotiations should be patterned after the present coal mine dispute. Some sources believe that if the knock-down-drag-out fight between the administration and Mr. Lewis results in a victory for the miners it will form a new pattern in the labor field—just as the 18½¢ an hr formula in steel last March paved the way for increases in wages and prices all along the line.

The loss in steel output because of a prolonged coal strike would be much greater than was the case in the early part of this year. At that time many steel companies had large stocks of coal which had been built up when the steel workers were on strike. This time however finds most companies with no more than two weeks supply on hand. Because the inventory is so small and because the feeling exists that the coal strike will be a long one more drastic plans are being carried out for reducing steel operations. Further, many steel sources fear that the blast furnaces will be out for such a long time that the lower operations cycle will run smack into the steel wage negotiations. In that case it is

By TOM CAMPBELL
News-Market Editor

o o o

said that many units which have been taken off have to be kept out of blast until the course of steel wage meetings is definite.

Had it not been for the coal tieup it is certain that the steel industry by next spring would have been able to eliminate all carryovers and would have been able to get steel ordering on a normal basis with steel consumers being able to set up definite manufacturing schedules with the knowledge that when they were ready for material they would get it. Now it appears according to market experts that the steel industry and its customers are in for another period of shortages, unbalanced inventories and shutdowns due to lack of steel.

Had inventories been balanced in manufacturing plants the loss of steel as the result of the coal tieup might have served as a deflationary factor in reducing large inventories. In the present case however many firms using steel will be unable to benefit much from their stocks since the latter are of a great variety of sizes, shapes and types all of which do not match together evenly enough to carry on a sustained manufacturing cycle. In some cases however it is expected that manufacturers, before the coal crisis and the possible steel labor problem are settled, will have used up a large part of what they now have in stock even though they will be forced to substitute where extreme shortages exist.

Other sources point out however that the railroad embargo will make it impossible for many plants to keep up manufacturing schedules even though they have the steel and the labor. Furthermore it was said that steel company shipments of material already made will be sharply curtailed as the result of the freight embargo. The general pattern may be then that business in general will suffer a na-

Strong Man

tional delay in production with the more serious aspect of losing millions of tons of steel that cannot be made up in the openhearth furnaces.

Looking back to the two strikes early this year, market observers shudder as to what the steel distribution picture may be next spring. It took months this year for the steel industry to recover from the loss of more than 13,000,000 tons of steel as the result of the steel and coal strikes. It has been only in the past month that many steel users have been able to get to a semblance of uninterrupted production. Others it is claimed have not yet obtained steel quotas which will support what is believed to be a fair level of activity.

Because some large industries like the automotive group have been operating almost on the basis of carload arrivals of short steel products the effect of the coal tieup there will be disastrous as far as layoffs and lack of cars are concerned. Furthermore while auto companies will be expected to use up all the inventory possible (it is greatly unbalanced as to required items) after the labor difficulties have been settled and steel starts to flow again most firms will be so short of steel that it will be months afterward before any semblance of the required steel supplies materializes. If the industry runs into a steel strike steel users can expect not only a pattern of distribution such as occurred this year but one in which the most annoying and most serious shortages will again appear and last for months.

STALLED AT THE MINEHEAD: *Fuel for the nation's industries sidetracked pending the show of strength between John L. Lewis and the government.*

Steel officials look for scrap supplies and prices to ease if the mills are down for any length of time. In many of the larger plants it will be more or less impossible or at least impracticable to keep openhearths going in scrap and cold pig iron. Hence dealers and brokers will find no urgency for shipments although it is expected that the more farseeing steel firms will attempt to use any shutdown period as one in which to build up scrap stocks as high as possible without deranging or unduly effecting a higher market price for scrap.

As to steel prices, any gain in wages that John L. Lewis gets for his men will mean higher steel costs and the fact that Philip Murray has promised a vigorous drive for higher steel wages can be taken as proof that steel prices in the first quarter of next year will be higher. Whether or not the steel industry can afford to give a definite "no" to any wage requests is hardly likely since such an answer would again shut down every plant in the industry. Again however steel officials have already made it plain that if steel wage costs go up prices will have to go up also no matter how reluctant companies may be to make such increases.

The sudden coal strike may cause some firms to hesitate on the announcement of price revisions expected to be made by Dec. 1 on those products which companies are claiming a loss or low return. On the other hand there is a strong group in some major companies which leans to the view that these increases will have to be made immediately without waiting to see the impact of costs to be made by any coal mine settlement. Whether this group will win out and prices raised in a few weeks remains to be seen, such thinking lost out on other occasions only to be vindicated by later developments.

A major fear in industrial circles is the fear that if wages and prices are again raised it may only add more impetus to the inflationary spiral. The reasoning back of this is the fear that the inevitable delay in supplying steel to fabricators may so curtail their operations as to kill off some of the backlog of consumer demand.

HOW LONG? *This desolate scene was made at the Hillman Black Diamond mine, after miners walked out of the pits at Monongahela, Pa. It takes just about* 2150 *lb of coal to make a ton of finished steel.*

Coal Strike Begins to Curtail Steel Operations in Pittsburgh Area

Pittsburgh

• • • **The coal strike,** which has shut down all steel producers' coal mines, has reduced operations in this district for the coming week to 74 pct and should the strike continue into next week, the rate will probably drop another 25 points. The brunt of the drop in operations was borne by two major producers, Carnegie-Illinois Steel Corp. and Jones & Laughlin Steel Corp. Carnegie-Illinois, in this district has only 14 blast furnaces operating and its steelmaking facilities were reduced to 35 pct on Monday night. J&L banked three of its 11 blast furnaces in Pittsburgh and Aliquippa and shut down 7 of its 24 openhearths in these plants. Its Aliquippa coke oven department had one battery shut off and the remaining three reduced to 50 pct operation, while at Pittsburgh one of its six batteries has been shut down.

Other steel producers anticipate that operation levels will be maintained for at least the balance of this week, but next week will see practically all companies, especially those heavy on openhearth capacity, going down. Weather will have a major effect on steel production in the near future, since a cold snap will require greater amounts of coal for steam lines and maintenance.

Thus, as the steel industry levels off in its first postwar production stride, the shortage of coal is forcing curtailments of operations that will, like production lost in any strike, never be made up. The work that the industry has done during the past three months in working over backlogs and rescheduling all orders on the books seems to be in vain, because the steel industry will end up any sort of a coal strike in a completely confused condition in so far as order schedules are concerned. There have not yet been any indications that mills are holding back order entries because of the coal strike, but this is likely to come just as soon as there are any indications that Lewis is victorious in his court battle.

While Carnegie-Illinois did not make any estimate of ingot tonnage lost by the strike, on Monday J&L estimated that about 3000 tons of ingot would be lost, an amount that would grow daily with reduced operations that will likely follow late this week. On Monday, J&L laid off 1100 men, a figure that would have been larger had the company not retained some of its Aliquippa Works openhearth crews for furnace repairs.

Currently, the steel industry seems to be watching and waiting. The events of this week will likely tell which way the wind will blow, and next week the operating rates of the various steel companies will be mute evidence of how long the steel industry believes the coal strike will last.

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Chicago Rate Falls To 75½ Pct; Embargo Will Cause Paralysis

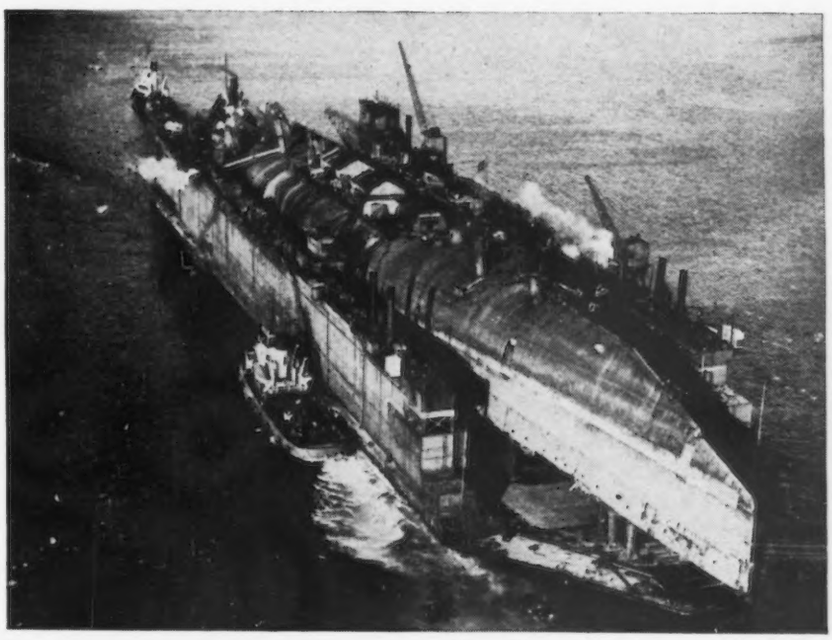
Chicago

• • • **A general paralysis** in the steel industry has been started in this area. The reaction of the coal strike on operating rates, which fell 16 points this week, will be much faster this time than in previous strikes. Faster closing down of steelmaking and ironmaking facilities is due to the probable railroad embargo on all freight. In fact, the embargo will shut the mills down faster than a stoppage in the coal mines. Deliveries of steel products will therefore be affected immediately and not have a chance to taper off as the operating rates go down.

Four blast furnaces were banked almost immediately in this area with Inland shutting down two, one of which was a merchant iron furnace, and Youngstown Sheet & Tube taking one off at the Harbor and one at South Chicago. A Bessemer plant of Youngstown Sheet & Tube was also suspended.

Three blast furnaces at Carnegie's Gary works and three at South Chicago were slated to be stopped and started fanning on Thursday. All of Carnegie's merchant mills plus the wheel and axle plants will be down flat by Sunday midnight, according to present plans. On the average, it is believed all steel makers in this area may be tightly closed within the next 10 days to 2 weeks. Normally the reserves of coal have permitted a gradual shutdown so that finish-

SCRAP FOR BRITAIN: *A German battle cruiser salvaged from Scapa Flow is carried up the Clyde to the breaking up yards at Faslane, England.*



ing operations and some openhearth melting could be continued even after the blast furnaces were banked.

With the rail embargo scheduled for the middle of the week, most producers stated that their operations would have to be discontinued. Abruptly as the mills cannot continue to roll when the mill warehouses and shipping platforms jam up with steel that cannot be shipped.

The shipment of either steel products or goods will fare a little better in the Midwest than in the East. The decision of whether to accept freight for shipment is up to the railroads as long as the business originates and is delivered on their own line. Anything that has to be shipped to a connecting point can only be moved on an ICC service order, the permits for which will come from the AAR in Washington. Because of the fact that more roads in this territory are dieselized than in the East, the roads here may continue to accept some carloads as long as delivery is to be made on their system.

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Auto Steel Supplies Critically Short; Some Shutdowns in Sight

Detroit

• • • **Even the most** confirmed optimists in the automobile industry are willing to concede that a prolonged tieup in the coal industry will have a devastating effect on the December output of automobiles.

While coal inventories of both automobile producers and the electric utility serving the Detroit area were reported to be at satisfactory levels, General Motors has reported that only a 24-hr supply of steel is currently available, indicating an almost immediate shutdown if steel supplies are cut off.

A survey of producers has revealed that Ford, Packard, and Hudson are only slightly better off than GM with respect to available steel. However, Chrysler and Kaiser-Frazer have indicated that sufficient supplies of steel are on hand to permit a continuation of operations for some time yet although at reduced schedules.

An even earlier plant shutdown is forecast for the automobile industry in the event that an embargo is clamped down on rail shipments. In that event, it is a foregone conclusion that the entire automobile industry and its thousands of suppliers will be pulled down immediately.

Meanwhile, the industry is declining to predict the course the coal strike is likely to take and is preparing for any eventuality. The industry is not inclined to expect anything less than a long and bitter contest before a settlement is reached.

SUPERSONIC PLANE: *Scheduled to make its first powered flight soon is the AAF's first rocket propelled plane. This first model may attain a speed of* 1000 *mph at* 60,000 *ft and completion of engine design will, it is hoped, boost this to* 1700 *mph at* 80,000 *ft. It is powered by a Reaction Motors, Inc., rocket engine built in four units and burning alcohol and liquid oxygen.*

Electric Furnace Meeting Date Set

Pittsburgh

• • • **Settlement of the hotel strike in Pittsburgh clears the way for the fourth Annual Electric Furnace Steel Conference AIME to be held next week as originally scheduled.**

The meetings will be held Dec. 5, 6 and 7 at the Hotel William Penn, Pittsburgh.

Apollo Steel Leased To Syndicate Composed Of 12 Sheet Consumers

Pittsburgh

• • • **A coast-to-coast** steel consuming syndicate will take over the operation of Apollo Steel Co. Twelve firms, all heavy users of sheets, have taken over the plant, with A. H. Maremont, Chicago, heading up the syndicate. Indications are that the plant will be operated as it now exists.

Approved originally by the board of directors and on Oct. 23 by the stockholders, the purchaser of the plant has been the subject of speculation for some weeks. The selling price is reported to be $2.5 million.

Irving Grayson, a Detroit attorney, purchased the plant for himself and a group of Detroit businessmen, and the plant is being leased to the 12-company syndicate.

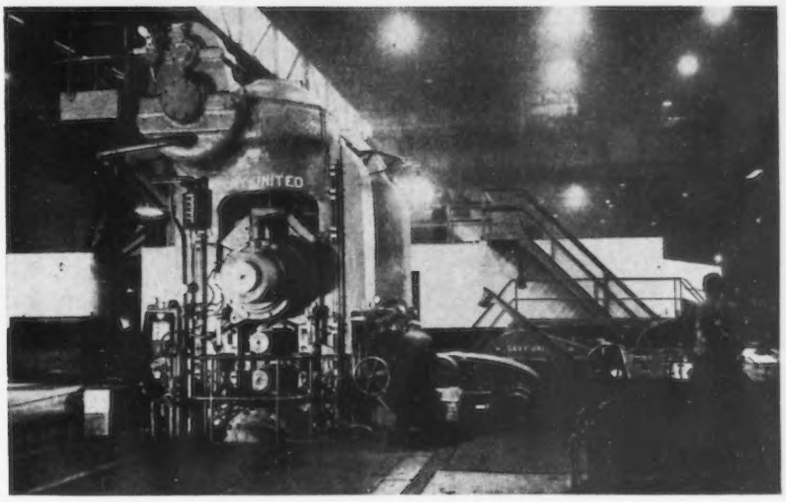
Mr. Maremont is vice-president of Maremont Automotive Products, Inc., Harvey, Ill., which makes parts for the automotive, farm implement and hardware industries.

Brooke Raises Price Of Pig Iron $2 a Ton

Birdsboro, Pa.

• • • **The E. G. Brooke** Iron Co., here, has announced an increase of $2.00 per gross ton on all grades of pig iron produced, including basic, bessemer, foundry, malleable and low-phosphorus. So far it has not been necessary to curtail operation of the blast furnace. However the management is not able to predict how long operations can be continued in view of the indeterminate status of the coal strike.

English Company To Install New 80-in. Cold Reduction Mill



Shotton, England

• • • **A new 80-in.** cold reduction reversing mill is now being run in by John Summers & Sons, Ltd., as an adjunct to their continuous strip mill which was completed in 1939. The mill is a four high unit to handle strip up to a maximum width of 74 in. Built by Davy-United, largely to American drawings, the new mill is the first important unit of the company's expansion program to be completed since the end of the war.

Interrupted by the war, this firm is proceeding with its planning and construction of an integrated mill as a nucleus. Steelwork is now going up for a new annealing bay, which the firm hopes to be using by the middle of 1947. Plans are complete for a new openhearth shop which is scheduled to be the next major construction unit. The firm expects to start construction work on the works within a few weeks. The existing plans call for either nine or ten 150-ton openhearths, which will in operation depend heavily production unit around the strip upon scrap.

At present there are two existing openhearth shops, one built about the turn of the century, and the other during World War I, but no blast furnace plant. The master expansion plan for the firm also makes tentative provisions for the eventual construction of a blast furnace plant to contain two furnaces, but the firm indicates that final decision as to this unit remains to be taken in the future.

Use of Electrical Power By U. S. Industries Increases 81 Pct Over 1939

Washington

• • • **Industrial use** of electrical power has increased 81 pct over the last prewar year of 1939, according to the annual report of the Federal Power Commission. Also, the report notes, increased use in states formerly not identified with industrial activity indicates a trend toward decentralization of industry.

Instead of registering a sharp decline because of reduced manufacture for military use, anticipated declines may not develop for 1946, the report said. Indications from preliminary reports are that the increased use of the six war years is continuing into the postwar period.

Chemicals, iron and steel, and nonferrous metals industries continue to demand the most power, it was reported. These three, in the order named, used 42.8 pct of the total 1945 industrial consumption of 143.2 billion kw. Industrial requirements declined only 15.6 billion kw from the wartime peak of 158.8 billion kw.

In 1945, total power production in the United States amounted to more than 270 billion kw, of which industry consumed 143.2 kw or 52 pct; of this amount, 46 billion kw or about 30 pct was generated in industry's own plants.

The report is further broken down so that industrial users as a group use only 7.7 pct of their total for lighting. Some 63.2 pct is required to operate motors or run power machinery and 13.6 pct for electric furnaces, leaving 15.5 pct for all other uses.

Although total industrial use increased more than 81 pct during the 7 yr period 1939-45, the report concludes, total electric power production increased only 68 pct in the same period.

POWER REQUIREMENTS BY INDUSTRIES
(In Billions of Kilowatts)

INDUSTRY	1946 (Estimate)	1945	1944	1939
Chemicals	21.5	24.5	29.1	9.7
Iron and Steel	19.4	21.7	23.2	12.2
Nonferrous Metals	11.8	14.9	23.7	5.9
Petroleum and Coal	6.3	6.5	6.2	3.4
Transportation Equipment	2.7	6.4	8.9	0.5
Machinery (General)	4.7	5.1	5.8	1.9
Automobiles	4.2	3.7	4.6	2.6
Machinery (Electric)	2.9	3.3	3.6	1.4
Coal Mining	5.5	5.3	5.2	3.5
Metal Mining	3.5	3.4	3.8	2.8

With the exception of mining, marked declines had been anticipated by the FTC in 1946 estimates for industrial use of electrical power due to reduction in military demands; however, indications are that final calculations may show these estimates as too low. The year of 1939 is used above as the last prewar year, 1944 as the peak war production year.

Operating Schedules of Steel Mills in Canada Now at Prestrike Level

Toronto

• • • **Canadian steel** mills had last week returned to normal prestrike operating schedules with steel ingot and castings production at a little better than 70 pct of rated capacity and pig iron output around 65 pct. Sheet, bar and plate mills are operating close to capacity, but nail production is only about 60 pct, largely due to the shortage of wire rods. However, Graham Nail Works, which was closed down for a short time, has resumed operations, and other producing companies also report an improvement in production over rates of the past three or four months.

Since Canada imports approximately half its coal and about 20 pct of its coke, the strike of John L. Lewis' United Mine Workers serves only to darken what looked like a brighter future for steel users here. Notwithstanding the improvement that has taken place in iron and steel output in the past two months, shortages in most materials continue to affect manufacturing activities and there is a critical shortage of many consumer goods, especially sanitary ware and various other items required in the building trades and in household equipment.

Effective Nov. 22, Ford Motor Co. of Canada, Windsor, gave layoff orders to some 2400 workers, reducing the staff to about 9500 men. The staff reduction is said to be due to the shortage of materials, mainly sheet steel, and indicates a 25-pct reduction in operations.

With improvement in steel deliveries a number of Canadian companies have started to speed up operations on production of equipment for export, and at the same time some new export business is being closed. The more active companies in the export markets are the railroad car and locomotive companies which have big orders from France, Belgium, India, as well as the agricultural implement industry which appears to be catering more extensively to the export markets than to domestic requirements; while motor vehicles also are prominent on export lists.

Canadian steel producers had been making progress in stepping up deliveries of steel, but so far there has been little or no actual easing in the supply situation, and the coal strike promises to make it worse. Backlogs of orders carried over from prestrike days are sufficient to absorb all output to the end of the year, and while some producers have withdrawn from the market with respect to new bookings on sheets, bars and plate to the end of the first quarter, others are accepting business on an if, as and when delivery basis.

On the heavier lines of steel it is doubtful that mills will reach a position where they can make shipments against orders now appearing until some time in the second quarter. However, there appears to be a large volume of duplicated orders, consumers ordering from all producers in the hope of getting delivery, and as shipments speed up there may be many cancellations.

Despite duplications and prospective cancellations, producers do not look for much easing in the supply situation until the middle of next year and believe that it will be a year or 18 months at the earliest before supply and demand are on an equal basis.

SUMMARY OF UNITED KINGDOM STEEL STATISTICS

Source: British Iron & Steel Federation

All Figures Thousands of Net Tons	STEEL			PIG IRON	SCRAP	IRON ORE	
	Ingots and Castings	Finished Deliveries	Steel Stocks (1)	Production (2)	Steelmaking Consumption	Imported Ore Consumption	Home Production
1944 Total	13599.0	11502.4	2431.5	7542.0	8252.6	2725.6	17332.2
1945 Total	13237.8	9992.3	1885.9	7959.4	8065.9	4494.7	15870.4
1945 September	1077.8	792.5	1415.4	624.9	650.0	438.1	1102.5
October	1360.8	932.4	1356.8	818.1	818.1	595.2	1385.4
November	1106.1	803.7	1358.0	672.0	659.9	467.7	1115.5
December	992.3	735.6	1332.4	651.8	592.7	449.7	1036.6
1946 January	1025.0	971.0	1370.9	803.6	754.8	541.5	1373.6
February	1107.5	833.2	1341.5	654.5	657.2	445.8	1147.3
March	1145.5	898.6	1314.7	659.9	695.2	484.2	1148.6
April	1129.4	827.0	1265.1	666.1	682.7	499.0	1090.8
May	1466.0	1139.0	1283.6	846.7	890.9	644.5	1371.4
June	1074.3	859.2	1266.3	678.7	640.1	531.7	1010.2
July	1012.9	791.1	1299.8	658.5	616.0	534.9	986.9
August	1265.0	968.2	1342.7	813.6	755.4*	665.8	1252.1
September	1068.4	930.4	1329.2	659.9	645.5	529.9	1027.2

[1] Held by producers and in British Iron & Steel Corp. stockyards at the beginning of the years and months shown.
[2] All qualities, including ferroalloys.
* Revised.

Weekly Gallup Polls . . .

Sympathies of French Public Are Sharply Divided

Princeton, N. J.

• • • **The divisions and** conflicts in French public opinion today are well illustrated in the results of a poll recently completed in France by the French Institute of Public Opinion.

Caught in the clash of interests between Russia on the one hand. and the United States and England on the other, France finds herself with one faction of the population siding with the United States, another with Russia, and still a third taking a "plague-on-both-your-houses" attitude.

To measure the differences of attitude the French Institute conducted the experiment of polling the country on the question of which side it would favor if Russia and the United States were ever to go to war against each other.

The results follow:

"If Russia and the United States went to war against one another, which side would you favor?"

	Pct
United States	40
Russia	21
Neither	33
No opinion	6

A bond of friendship has existed between the United States and France ever since the American Revolution, when Lafayette's assistance symbolized French support and goodwill. More than a century later we came to the aid of France in the first World War, and again found ourselves partners in the second World War. Today, however, there are signs that the ancient friendship between the American and French people is wearing a bit thin, if the recent poll results are a criterion. Only two Frenchmen in every five say their sympathies would lie with us in a war against Russia. Note that the poll question does not suggest military assistance or intervention by France in such a war; it deals only with the question of where the sympathies of the French people would lie as onlookers.

In politics, as is well known, the French people are divided into three main camps—the Socialists, the Communists and the MRP (Mouvement Republicain Populaire).

In spite of the differences of opinion which the poll finds, the majority of Frenchmen in the past have felt that the United States had done more than any other country to aid French recovery from her collapse in World War II. The French Institute has polled the nation several times on that issue, and the trend of sentiment was as follows:

"Which nation do you think has helped most toward the recovery of France?"

	April 1946 Pct	May 1946 Pct
United States	50	63
Russia	17	12
Great Britain	8	4
Others	3	5
No one	8	3
France is recovering alone	5	7
No opinion	9	6

•

• • • **The Democratic Party** has lost ground among all the major occupation groups, but the biggest defection in the Nov. 5 elections came among manual workers. Members of labor unions also showed a big shift.

Polls conducted by the institute just before election day found that pro-Democratic sentiment among labor union members outside the South had dropped nearly 20 points as compared to 1944.

Manual workers as a group showed a defection of eight points as compared to the last midterm election.

Here is how the various major occupation groups voted in the Nov. 5 election, as indicated by the poll. The percentages exclude the South, where most Congressional races are settled in the primaries not in the November general election. They also exclude Maine, whose Congressional races are always run in September, and California, where many seats were uncontested this year because

Major Occupation Groups And Veterans Favored Republican Party in Recent Elections

o o o

candidates had won nominations from both parties.

	Rep. Pct	Dem. Pct
Prof. & Bus.	70	30
White Collar	65	35
Farmers	67	33
Manual Workers	53	47
Labor Union Members	49	51

That is a markedly different political picture from that found in other recent elections. Whereas the professional and business group has been pro-Republican for many years, and the farmers outside the South long ago turned against the Democrats, the manual workers and white collar workers gave the Democrats overwhelming majorities in 1936 and 1940. The labor union vote was also heavily Democratic; in 1944 labor union members outside the South were nearly 7 to 3 for Franklin D. Roosevelt.

•

• • • **The Republican Congressional** victory was to a large extent brought about because young voters and middle aged voters shifted away from the Democratic Party.

The Democratic landslides of other years would never have been possible except for the overwhelming support which young voters—those under 30 yr of age—continually gave the party.

The middle-aged voters—those between 30 and 50 yr of age—also shifted markedly this year. This group is highly important because it carries in its ranks about twice as many voters as are to be found among the young age group.

In the following table there are two things shown. One, the poll findings on how the different age groups voted. Two, a picture of the dramatic shifts which took place within a 6 month period be-

(CONTINUED ON PAGE 148)

CIO Eyes Net Profits of Industry In Lining Up New Wage Increase Demands

Atlantic City, N. J.

• • • **The CIO in** proclaiming its intention of a new wage increase, indicated that its demands would be based upon industry's ability to pay, and claimed that American industry in 1947 would earn the highest corporate profits in history, estimated at $9.5 billion after taxes. The view of Walter Reuther, president of the CIO-United Automobile Workers, was backed up by Philip Murray. That view, expressed in the General Motors negotiations last year, is that industry is able to pay wage increases without inflationary price increases and still make profits exceeding both war and prewar levels. It was indicated, however, that there would be no demands by the CIO to investigate accounting procedures and the books of large companies, one of the main points of contention in the UAW-General Motors negotiations.

"Economic Outlook," a publication of the CIO, examined the question of wages and profits and stated that the record profits vindicate the position taken by the CIO on wage increases in early 1946. It stated further that industries could have paid those increases on their products and still have had profits equal to those made during the war years, 1942-1945.

A reasonable profit after taxes, according to the "Economic Outlook" is $5 billion which, it said, equals the wartime figures and is twice the average profits for 1936-1939. It said that workers had received 67.7 pct of the national income during the war, but this has declined during the first eight months of 1946 to 62.6 pct, or 0.9 pct less than the 1936-1939 average. A weekly income for workers regarded as necessary for the maintenance of minimum health and decency is $68.19 a week or $23.09 a week more than the $45.10 average prevailing in September.

The CIO convention at Atlantic City examined a series of resolutions that would guide the affiliated unions in formulating their individual wage demands. Wage increases sufficient to offset a 25 pct loss in purchasing power since April, 1945, would be sought. The resolutions also included the CIO policy with regard to a minimum wage of 75¢ an hr; guaranteed minimum annual wage, and certain pension and health benefits.

Walter Reuther, president of UAW, urged that a CIO common "war chest" be set up to back any single union undertaking a fight for higher wages. He recommended that the money pool have assets totalling $10 million to $12 million. Heading up the wage demands was Reuther, who said that his union would seek a 20 pct pay increase, based upon a depreciation of average earnings by 20 pct since January, 1945.

Philip Murray, still non-commital on just how much will be asked in the way of wage increases, repeated that employers would be presented with a formal request for substantial wage increases without inflationary price increases.

Auto Workers Start "Walking Time" Suits

Detroit

• • • **Portal-to-portal pay** for its workers promises to be a new wage issue confronting the automobile industry.

Claiming they were "forced to change their clothes on their own time" for 18 minutes each day, 75 employees and former employees of Allison Div., General Motors Corp., have filed suit in the U. S. District Court for "wages due." The workers are seeking back pay for "the time consumed in travel from gates to the locker rooms, in changing clothes, checking out equipment and other necessary duties that must be performed prior to the shift starting time.

Meanwhile, workers at the Saginaw gray iron foundry of GM have filed a back-pay for "walking-time" in bargaining negotiations and a similar claim has been added in an amendment filed recently to an overtime suit by the local of Continental Motors Corp. The suit was originally filed July 1, 1946.

Demands for portal-to-portal payment on an hourly basis beginning from the time workers enter the plant will be served by the United Steel Workers of America-CIO on the United States Steel Corp. next January.

Blast Furnace Capacity and Production—Net Tons

	Number of Companies	Annual Blast Furnace Capacity	PRODUCTION							
			PIG IRON		FERROMANGANESE AND SPIEGEL		TOTAL			
									Pct of Capacity	
			October	Year to Date	October	Year to Date	October	Year to Date	October	Year to Date
DISTRIBUTION BY DISTRICTS:										
Eastern	12	12,988,970	888,748	6,776,217	26,402	190,160	915,150	6,966,377	82.9	64.4
Pittsburgh-Youngstown	16	25,939,940	1,913,870	14,232,370	19,453	139,860	1,933,323	14,372,230	87.7	66.5
Cleveland-Detroit	7	6,557,500	513,036	4,030,085	.....	.....	513,036	4,030,085	92.1	73.8
Chicago	7	14,093,510	1,007,136	7,870,272	.....	.....	1,007,136	7,870,272	84.1	67.0
Southern	9	4,924,670	320,390	2,609,288	15,717	95,239	336,107	2,704,527	80.3	65.9
Western	5	2,836,000	109,809	965,853	.....	.....	109,809	965,853	45.6	40.9
Total	37	67,340,590	4,752,989	36,484,085	61,572	425,259	4,814,561	36,909,344	84.1	65.8

Source: American Iron & Steel Institute

Strike Clouds Market Picture For Buyers of Iron and Steel Scrap

Pittsburgh

• • • **The scrap market** appears to be simmering down especially in the heavy openhearth grades. Buyers are resisting any further upsurges of prices beyond present levels of $25 to $25.50 for No. 1 in Pittsburgh, only because of the effect of such prices on steel itself. Since purchased scrap accounts for about 25 pct of the weight of an ingot, it is obvious why there is resistance to higher prices.

Mills generally felt that during the latter months of OPA that the scrap industry, held to OPA ceilings without any relief, had been dealt with rather harshly. The scrap industry advocated a $3.50 a ton increase and the mills seemed to be generally in accord with this. However, when OPA controls were removed, the price shot up $5.00 a ton or more.

On top of this $5.00 a ton increase, steelmakers are still paying the freight from the shipping point to the mill. Actually, the price range on No. 1 of $25.00 to $25.50 is only part of the total price picture and applies to scrap generated in the Pittsburgh trading area. The freight, of course increases proportionately with the distance the scrap must move, hitting a figure of about $7.00 a ton from the New England area where much of the Pittsburgh consumed scrap originates.

On specialty grades, such as cast, and on certain steel grades, used largely by foundries and special consumers, the price is even more ridiculous, according to experts here. No. 1 cupola cast, quoted at $28 to $30 Pittsburgh, is actually costing more than this price quotation would indicate. Taking for granted that the spread includes brokerage fees of 50¢ a ton, such scrap is still on an f.o.b. basis, and in addition is the basis for barter.

In other words, the price is actually $28.00 to $30.00, plus freight, plus the privilege of buying perhaps a dozen bathtubs, a carload of nails, a supply of radiators, or any of a number of other items. While this privilege to buy cannot be represented as so many dollars and cents, it most certainly is worth cash, those "in the know" say here.

Some mills and some of the larger foundries are beginning to tighten up on the amount of freight they will pay for scrap coming to them. Much of the scrap consumed here is moving in from the east, where the base price is reported to be in the neighborhood of $20.35. The springboards permit this movement and very little more. This again tends to tone down upward movements of scrap prices.

The coal strike—or walkout—will have a definite effect on scrap prices, especially when blast furnaces are banked and steelmaking operations are curtailed. Steel mills will continue to take in as much scrap as possible, but, more important, according to sources here, it will be only on the basis of what the mills will pay. There are two schools of thought on the effect of a strike on the scrap market. Some observers predict that the curtailment of steelmaking activities will lessen the pressing immediate need for scrap. Others maintain that if steel operators attempt to keep the ingot rate up in the face of a shortage of coking coal, and hence of pig iron, the demand for scrap will be increased to a point even higher than it is now.

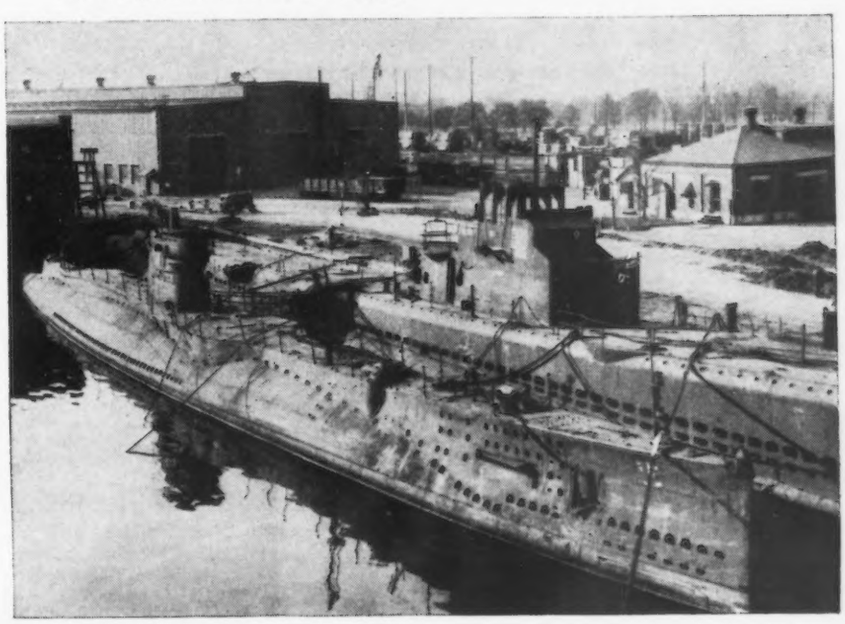
Further, the possibility of a steel strike early next year tends to make scrap market prediction an even more difficult game, according to dealers and brokers here. Many of them are getting cautious about what they will pay for scrap for their own stocks, buying only where they know they can sell immediately. They indicate they are aware that inventories bought at today's prices might mean a loss within a few weeks. Caution seems to be the word on dealer purchases for inventory.

NHA Drops Some Items

Washington

• • • **Batching plants,** rock crushers of 25 tons or less, and tractor-type scrapers have been removed from the NHA list of surplus items (Reg. 3) which must be held for priority claimants. Also, time of the regulation has been extended 60 days to Jan. 16, 1947.

UNDERSEA BOATS FOR SALE: *The Navy is releasing a number of its older submarines for competitive bidding. These vessels are destined for the scrappile to permit steel mills to continue in operation. Shipbreakers on both coasts have bought submarines for scrapping.*



Metallurgists Hold Custody of Resources, Says Walter S. Tower

Atlantic City

• • • **Metallurgists** are custodians of materials on which the welfare of countless generations must depend, stated Walter S. Tower, president of the American Iron & Steel Institute, before members of the American Society for Metals at their annual dinner here. Mr. Tower said that every advance in the science of metallurgy tends to make metals more serviceable, to enhance their economic value, and to prolong the life of existing natural resources.

Mr. Tower stated, "The metallurgist has dug deep into his bag of tricks and come up with industrial applications of elements which were, until a few years ago, largely laboratory items. Our whole manner of living would be far different without the wide range of qualities of the numerous alloys which the metallurgist has made available. Many of these metallurgical marvels have been designed specifically for the benefit of the distaff side of the house, such as the gleaming stainless sink, the enameled gas range, stainless or clad metal pots and pans, satin-like silver and keen carving tools.

"The wider and more attractive horizons to lure the venturesome metallurgist now seem to lie in the direction of preparing metals for use, since the basic knowledge of separating metals from ores has been pretty well solved and great strides have likewise been made in the metals and economies of refining metals."

Commenting on some belief that the use of ferrous metals (steel, iron and their alloys) may be displaced in the not distant future because of desirable qualities of the light metals, aluminum and magnesium, Mr. Tower declared, "It does not seem likely that future progress of metallurgical skills will bring any considerable displacement of ferrous metals by the non-ferrous. It is likely, and perhaps desirable, that in some uses other metals may take the place which some kind of steel has heretofore occupied. However, as we know metals, it seems clear that the broad foundation of industrial use of metallic products must continue indefinitely to rest on the ferrous family. That conclusion is supported by the facts in regard to potential supply, prospective cost of production, price to the user and versatility in use.

"In none of those four respects has the ferrous family any serious rival. What the metallurgist has done and can still hope to do in preparation of ferrous metals for use has no parallel elsewhere.

"In every consideration of the use of metals, it is important to recognize that we are dealing with exhaustible resources. Every ton of metal extracted, refined and put to use is an irreplaceable subtraction from the aggregate which this earth offers. Some metals, once used, can be recovered from scrap, and in secondary form contribute substantially and repeatedly to the needs of industry. But existing resources cannot be increased by any magic of metallurgists. Synthetic metals in quantities are beyond the imaginings of fiction. You metallurgists, therefore, are custodians of materials on which the welfare of countless generations must depend."

Tata Steel of India Reports Steel Ingot Output of 1,135,000

London

• • • **The annual report** of the Indian firm, Tata Iron & Steel Co., Ltd., reveals that for the year ended Mar. 31, 1946, the output of steel ingots totaled 1,135,000 tons and pig iron 1,126,000 tons.

J. R. D. Tata, chairman of the company, in his speech at the annual general meeting, said that while the coal situation still remained unsatisfactory, there had been some improvement since last year so far as the steel industry was concerned, but allocations to the works were still less than requirements.

He referred to the appointment of an Advisory Steel Panel by the Indian Government to examine the future development and organization of the steel industry. The panel had already submitted its report to the government and its proposals were under consideration. In view of the apparent trend of public opinion in India in favor of nationalization of basic and other industries and the recent steps taken in that direction in the United Kingdom, the industry was anxious to know how it stood in the matter.

Coming Events

Dec. 2-4 Society of Automotive Engineers, air transport meeting, Chicago.

Dec. 2-7 National Power Show, New York.

Dec. 5-7 Electronic Microscope Society of America and American Society for X-ray & Electron Diffraction, joint meeting, Pittsburgh.

Dec. 5-7 Electric Furnace Steel Committee of Iron & Steel Div., American Institute of Mining & Metallurgical Engineers, annual conference, Pittsburgh.

Dec. 6-7 Northwest Mining Assn., annual meeting, Spokane, Wash.

Dec. 9-11 Society for Experimental Stress Analysis, New York.

Dec. 16-18 American Society of Refrigerating Engineers, annual meeting, New York.

Jan. 6-8 Institute of Scrap Iron & Steel, Inc., convention, New York.

Jan. 27-31 Electrical Engineering Exposition, New York.

Jan. 27-31 International Heating and Ventilating Exposition, Cleveland.

Jan. 28-Feb. 2 Society of Plastics Engineers, exhibition, Chicago.

Mar. 17 American Institute of Mining & Metallurgical Engineers, world conference on mineral resources, New York.

Mar. 17-19 American Society of Lubrication Engineers, annual meeting, Pittsburgh.

Mar. 22 Western Metal Conference and Exposition, American Society for Metals, San Francisco.

Apr. 29-May 1 Industrial Packaging and Materials Handling Exposition, Industrial Packaging Engineers Assn. of America, Chicago.

The London ECONOMIST

The Russian Budget

Reprinted by special permission to further understanding on how political and economic affairs are viewed in London.

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THE budgetary year in Russia begins on Jan. 1. Nevertheless budget estimates for the current year were laid by the Soviet Minister of Finance, M. Zverev, before the Supreme Soviet only in the middle of October—last year M. Zverev made his budget speech in April, and in 1944 as early as in January. This year's unduly long delay in the publication of the budget estimates suggests that it took the Soviet Government some time to make up its mind about supposedly controversial points of financial policy.

M. Zverev has not stated explicitly what these points were. But he gave several hints indicating that the central problem preoccupying his ministry has been the fluctuation of prices and wages in Soviet industry and its effect on the budget. Analyzing last year's budget, *The Economist* remarked that it reflected "an undefinable element of price inflation; and that that inflation has developed even in the most rigidly controlled sectors of the Soviet economy, where the government's price-fixing machinery is, in theory, supposed to work perfectly and smoothly, meeting no economic resistance."

In this year's speech the Soviet Minister of Finance has pointed rather sharply to that "undefinable element of price inflation" and warned his audience that the reality of the estimates depends to a large extent on whether the inflationary tendency can be stopped or not. The seemingly paradoxical feature of the situation is that since the end of the war the more or less uncontrolled prices of foodstuffs have, according to all reports, fallen rather sharply; and that the rise in price has been registered precisely in "the most rigidly controlled sectors of the Soviet economy."

M. Zverev has repeatedly illustrated his point by examples of an increase in the cost of production in various branches of heavy industry—coal, metallurgy, and machine building—that is, those branches in which the government's price-fixing machinery has in the past worked most efficiently. The increase in the cost of production has been due primarily to a decrease in efficiency caused by wear and tear of industrial equipment, or by its poor quality, or by postwar weariness of workers or by a combination of all these factors. In extreme cases the cost of production in various industries has exceeded the planned prices by as much as 100 pct. The nature of this inflationary trend is, of course, very different from inflationary tendencies in capitalist countries.

It has, on the whole, very little to do with the pressure of any unsatisfied demand on the market. State-owned trusts are demanding higher prices from other state-owned trusts exclusively under the pressure of increases in the cost of production. The new structure of prices is baffling those who plan the country's economy, in spite of the fact that in the Soviet economic system industrial prices are immune from the fluctuations of supply and demand. What baffles the planners is the postwar lowering of industrial efficiency, directly reflected in prices. It is, however, impossible to say just how wide a field of Soviet industry has been affected by this inflation *sui generis*. M. Zverev has given no precise clue to this question.

THE following table compares the chief items of the budget for 1945 with the estimates for 1946 and also with the budget for 1940, the last year of peace for Russia.

(In billions of roubles)

	1940	1945	1946
Revenue	180.2	302	333.4
Turnover tax	105.8	123	200.8
Levies on profits ...	..	16.8	16
Direct taxes	..	40	23.5
Expenditure	174.3	298	319.3
Defense	56	128	72
National economy..	57.1	74.3	102
Social services	43	62.1	83

In spite of the important reduction in defense expenditure, this year's budget is 10 pct higher than last year's. But do the higher figures represent an increase in real values? Since economic activity in 1946 could not have been greater than in 1940—it is the objective of the present Five Year Plan that industry should reach its prewar level—the overall increase in all items of expenditure and revenue compared with 1940 must represent an increase in nominal and not in real values.

The peculiar structure of the Soviet budget needs some explanation. The chief source of revenue is the turnover tax, which is an indirect tax mainly on consumer goods. It constitutes a fairly sensitive index of consumption. In some prewar years two thirds of the revenue came from this source. Immediately before the war curtailment of consumption was reflected in the smaller share of the turnover tax in the total revenue. In the middle of the war, in 1943, turnover tax contributed only one third of the revenue; the level of civilian consumption was then at its lowest. In 1946 that tax is expected again to yield nearly two thirds of revenue—in absolute figures nearly twice as much as before the war and three times as much as in 1943. This points to greatly increased consumption, though it should be remembered that Russian consumption is rising from an extremely low level.

THE taxes on profits made by industrial concerns in 1945 yielded several billion roubles less than had been planned because, with rising cost of production, the margin of profits narrowed; and no higher revenue from this source has been planned for the

[CONTINUED ON PAGE 144]

Steel Plant Proposed for Philippine Islands

Washington

By KARL RANNELLS
Washington Bureau

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• • • **Breaking up of** the Japanese war industries, which offers a good chance of obtaining necessary industrial machinery and equipment in the form of reparations, has caused a renewed interest in the creation of new metalworking industries in the newly independent Philippines.

Among projects which have been given serious consideration, one of the most ambitious has been the establishment of a modern, well-equipped steel plant. Adding impetus to the proposal is the fact that the Philippines are dependent upon the United States and other countries for their iron and steel products despite fairly large ore deposits in the islands.

Several arguments have been advanced in favor of such a move The chief port, Manila, is strategically located in the center of a circle which includes the Solomons, New Guinea, Siam, Dutch East Indies, Singapore, Burma, Indo-China and the Straits Settlements.

With the exception of coal, many of the raw materials are available in the islands. Such a basic product as iron ore, running as much as 60 pct, was mined and shipped by several companies up to and during 1941. Materials not available in sufficient quantities could readily be obtained from adjacent countries and used as a base of trade.

While there is but one known coal field (Polillo Island), the low cost of water transportation is held to make it feasible to seek and help develop deposits in other parts of the Southwest Pacific for transport to the Philippines. It is pointed out that the Japanese blended Saigon coal with their own to make a satisfactory stoking coal, and that coke is readily imported from Borneo and Australia.

It is also believed that a satisfactory grade of briquette may be obtained in limited amounts by mixing high-grade Indo-China semianthracite with Polillo fines.

Industrial power is available by harnessing the Agus River, Mindanao, at the Maria Cristina Falls, less than 3 miles from tidewater. It has been estimated that a minimum of 730,000 kw of hydro-electrical energy could be obtained for the operation of metallurgical and other industries.

A leading proponent of setting up the Islands' own steel production facilities has been Charles A. Mitke. An engineer with long experience in the Philippines, Mr. Mitke is a former advisory engineer to the Commonwealth Government.

Because of the destruction of records by the Japanese during the war and the subsequent disorganization of industry, information concerning the various iron deposits and their analysis is sketchy and largely dependent upon Mr. Mitke's personal knowledge and records. He is generally regarded as the best available authority since, at one time or another, he has inspected most of the Islands' mineral deposits.

In this connection, the following summary adapted from a report by Mr. Mitke earlier this year, a copy of which was forwarded by the American Consulate to the State Dept., represents the most authentic survey of mineral resources of the Philippines available at the present time:

Philippine Iron Mines, Inc., Larap. This property, with two mines operating, has an annual production capacity of 600,000 tons and a reserve capacity of 8,000,000 tons. In the course of each year's operations, however, a limited amount of additional ore is uncovered so that ultimately a considerably greater amount will be mined than the known reserve. The present minable horizon consists of about half-and-half hematite and magnetite; extraction is part open cut and part underground mining.

Insular Mine Operators, Inc., Paracale. Insular's one mine at this location has an annual capacity of 200,000 tons with a known reserve of 8,000,000 tons, largely hematite and obtained from open cut. Barges towed by tugs are used to transport the ore to Paracale Bay, where it is loaded on ships or taken to Larap.

Surigao Iron Mine. This field contains one of the largest known iron ore deposits in the Island —approximately a billion tons, enough for 13 yr of operations. Formerly owned by the United States Government, it has since been turned over to the new Philippine Government. This field is a laterite deposit which was studied by the Mitsui engineers in 1940 who, possibly with the thought of the imminent war in mind, reported that it might take as much as 5 yr to work out the metallurgy of the ore. They also ventured the opinion at the time that the Japanese furnaces could not stand the extremely high heat required to melt the Surigao deposit.

Mati Iron Mines. Owned by the Philippine Iron Mines, Inc., this is a small deposit located about 50 km southeast of Davao. It is a new development, first drilled in 1940 and with one million tons

ANALYSIS OF PHILIPPINE IRON ORE

(Figures are percent)

Mine	Iron	Sulfur	Phosphorus	Moisture
Philippine Iron Mines, Inc.	60.0	4.5	0.7	7.0
Insular Mine Operators, Inc.	60.0	0.7	0.3	6.0
Gold Star Mining Co.	61.0	0.6	0.3	6.0
Samar Mining Co.	60.0	0.4	2.5	7.5
Mati Iron Mines	60.0	2.5	0.4	6.0
Sibul Springs	60.0	...	...	
Surigao* (Approximately)	48.0	...	...	10-18

* Sulfur and phosphorus content of the Surigao ore is not estimated in the report which, however, does show the presence of about 1 pct each of chromic oxide, nickel and manganese.

This analysis chart was compiled by THE IRON AGE from information provided the State Dept. by Consul General Paul P. Steintorf which was based largely on reports by Charles A. Mitke, mining engineer.

blocked out when the war began; consequently, estimates of the reserves have not yet been completed but it may be noted that there are several other small deposits within a 50-km radius of this new works.

Sibul Springs, Bulacan. In contrast with the Mati mines, the Sibul deposit on Luzon is possibly the oldest in operation in the islands, having been worked for close to three centuries, using small charcoal furnaces. Products made from its ore, such as plowpoints and iron utensils, are to be found in almost every hardware store in Manila. It has a reserve of more than a million tons.

Gold Star Mining Co., Marinduque. The annual capacity of this mine runs around 300,000 tons. The estimated ore reserves are placed at about 6,000,000 tons. Extraction is by open cut.

Samar Mining Co., Inc. Also extracted by open cut, this mine has an annual production of 400,000 tons with its ore reserve estimated at 4,000,000 tons.

Limestone. Limestone containing very little silica may be obtained in a number of places. One of the purest deposits discovered to date is located on a small island near Masbate.

Coal. Only one known deposit has been found. It is estimated to hold a reserve of more than 1,000,000 tons.

Coke. Polillo fines may be mixed with Indo-China high-grade semianthracite and the resultant mixture treated to produce a reasonably good coke in limited quantities.

At present, there are no known sources of oil or natural gas in the Philippine islands.

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Recommends Removal Of Japanese Aluminum And Magnesium Plants

Washington

• • • **Complete removal** of all Japanese industrial plants which had been devoted to manufacture of synthetic rubber, aluminum and magnesium as well as those making arms and munitions is recommended in a report to President Truman by Ambassador Edwin A. Pauley, U. S. Reparations Representative.

Ambassador Pauley also recommended substantial removals of facilities for iron and steel, iron ore and ferroalloy minerals, copper, machine tools, chemicals, heavy industrial machinery, electric power, communications and equipment, railroad equipment and rolling stock, shipbuilding and merchant shipping.

It was recommended, however, that the following be excluded from reparations: Mining of coal, gold and silver; refining of zinc, lead, tin, sulfur and pyrite; crude rubber processing; manufacture of light electrical appliances, lumber and sawmill equipment and machinery, and building materials; petroleum production, and all handicrafts.

Left for later determination were decisions on woolen textile machinery, synthetic fibers, cotton, paper and pulp.

In the report, strong recommendations were made against four types of reparations—labor, current production, stocks and materials on hand, and stocks and bonds of commercial enterprises in Japan.

"As to recurring reparations (current production) . . . they could only be achieved by expanding the industry of Japan," Mr. Pauley said. "The result would be to leave Japan . . . both with a surplus capacity convertible to war potential and with a competitive potential in export markets."

Mr. Pauley's report on Japanese reparations is in line with a previous statement in which he vigorously opposed a suggestion that restrictions be eased on industrial demobilization of the Ruhr-Rhineland area of Germany in order to produce materials for reparations.

WAA Offers Batteries

Washington

• • • **WAA is offering** for sale approximately $2,500,000 worth of new and used industrial lead acid storage batteries. They are being offered at fixed prices, equal to manufacturers' current list prices for similar and equivalent batteries. WAA said that these prices will apply to all levels of trade and that no dealer discounts will be provided.

Offered in lots of similar type, the inventories consist of power, marine, communications and aircraft batteries.

DIECASTING PLANT LOSS: *A $250,000 fire loss occurred at the Rupert Diecasting Co., Kansas City, Mo. when hot oil came into contact with molten aluminum and flames enveloped the ceiling of the plant.*

Industrial Briefs...

• NEW PRODUCT NAME—Fischer & Porter Co., Hatboro, Pa., manufacturers of variable area type flow rate instruments, heretofore called "Rotameters" has recently announced its intention to change the name of its products to "Flowrators."

• BUILDS NEW PLANT—Di Machine Corp. (a division of the Diebel Die & Mfg. Co.), manufacturer of the Diebel hi-speed automatic punch press, has recently completed a new factory located at 2711 W. Irving Park Road, Chicago.

• NEW MACHINERY FIRM—The American Machine Works, Inc., Racine, Wis., has been organized to manufacture wire stitching machines. Incorporators are Bernard Barnes, Peter Brehm, Walter Hayek and William M. Storms.

• MORE CHEMICALS — Government approval of the Monsanto Chemical Co. estimated $4 million expansion at Monsanto, Ill., will involve an eventual increase of 200 new employees. Four separate projects are involved; enlargement of chlorine and laboratory facilities, enlargement of facilities for the manufacture of wood preservatives and expansion of the plant boiler house. New facilities for the production of miscellaneous chemicals are also being planned. The expansion is to be completed by the end of 1947.

• AIR COMPRESSOR MANUAL — The Quincy Compressor Co., Quincy, Ill., has just released a 146 page manual for servicing air compressors. Believed to be the only one of its type, the new manual combines service data and parts lists with the information clearly written and illustrated in the style used successfully in field manuals for the armed forces. The manual is available without charge to industrial jobbers who handle this line and who maintain an authorized Quincy service department.

• WICKWIRE ADDS OVENS — Wickwire Spencer Steel Co. has started alterations at its Palmer, Mass., plant. Primary work concerns provision for new annealing ovens.

• EXPANDS BELOIT WORKS — Fairbanks, Morse & Co., Beloit, Wis., has plans for the immediate construction of a new building to house its diesel-electric locomotive division. Estimated cost is $625,000.

• NEW STEAM PLANT—Alabama Power Co. will build a steam plant to cost more than $10 million in the Gadsden, Ala., area. The plant will be laid out for two units with an initial capacity of 120,000 kw. The first unit is expected to be in operation about the end of 1948, and the second unit about August 1949.

• ACQUISITION — The Barium Steel Corp., New York, announces it has acquired full control of the Cuyahoga Spring Company, of Cleveland, Ohio, manufacturers of steel wire coil springs, wire forms and patented steel clips.

• MACHINE FIRM EXPANDS — A modernization program designed to greatly increase its heavy machine tools production capacity has been launched by Thomas Machine Mfg. Co., Pittsburgh. Additional facilities made possible by the modernization program will be capacity to produce a greater number of large steel fabricating machines and for the manufacture of custom built machinery.

• BACK TO THE FARM — Solar Aircraft Co., who during the war manufactured airplane engine exhaust manifolds, has announced that it is adding dairy equipment to its line. The plants in San Diego and Des Moines, Ia., will start production in the near future.

Washington

(CONTINUED FROM PAGE 90)

bright Act as well as the $100 million promised in the Philippine Rehabilitation Act of 1946. The remainder of the sales was for collar credits.

Under the act authorizing United States participation in the work of UNRRA, property costing $142 million has been transferred to that agency for which $94 million was received, a relatively high return if we disregard the fact that the United States still pays the bill. This property consisted of food, clothing, transportation and industrial equipment.

Donations of surplus acquired at an original cost of $34 million were made outright to colleges, religious orders, and organizations such as the foreign equivalent to our Boy Scouts, etc. Property representing a cost of $427 million was abandoned or marked for destruction when it was determined that there was no peacetime use, no market, or the cost of marketing was found to exceed the estimated return. Almost half of this category, the FLC report asserts, is represented in the now abandoned Stillwell Road and the aid-to-Russia highway constructed in Iran. Airfields built for emergency military use make up most of the remainder.

Like WAA, the FLC is confronted with a problem which is growing tougher all the time. While it is estimated that 80 pct of the $2.5 billion overseas property yet to be declared surplus is salable, there are several drawbacks to rapid disposal.

Part of the property is located in Germany and Japan and will not be declared surplus until the occupation forces are through with it. Also, there is lessening demand for bulk sales and the amount of property suitable for purely civilian use is decreasing. Climaxing the whole problem is the fact that as the months pass, obsolescence and deterioration are making greater inroads.

Apparently, the problem of surplus disposal is one which will continue to plague the government and its agencies for a considerable time to come. Its overall problems tend to become smaller as the totals decrease, but by the same token they will become even more puzzling.

Construction Steel . . .

New York

• • • **The estimated total** bookings of fabricated structural steel for the month of October 1946, according to reports received by the American Institute of Steel Construction, amounted to 138,953 tons. The estimated total for the first ten months of the year was 1,523,445 tons, or an increase of 23.2 pct over the average of 1,236,426 tons booked for the same period in the 5 prewar yr 1936 to 1940.

October shipments totaled 149,273 tons. The shipments for the 10 months, amounting to 1,236,805 tons, were slightly higher than the average reported for the same months in the 5 prewar yr—1,215,089 tons. The tonnage available for future fabrication at Oct. 31 amounted to 659,924 tons.

Following is the complete tabulation of bookings and shipments:

	Estimated Total Tonnage for the Entire Industry 1946	Estimated Total Tonnage for the Entire Industry Avg. 1936-1940
Contracts Closed		
January	235,817	107,578
February ..	132,707	96,280
March	173,871	124,558
April	128,671	110,783
May	165,290	126,237
June	131,010	125,835
July	137,241*	152,481
August	165,590*	113,135
September ..	114,295*	137,982
October	138,953	141,557
Total	1,523,445	1,236,426
Shipments		
January	107,490	92,578
February ...	63,803	88,626
March	102,803	115,031
April	122,511	123,650
May	124,408	123,225
June	126,850	129,969
July	140,224*	127,422
August	157,510*	136,389
September ..	141,933*	137,255
October	149,273	140,944
Total	1,236,805	1,215,089
Tonnage available for fabrication within the next 4 months ...	659,924	348,056

*Revised.

• • • **Fabricated steel awards** this week included the following:

840 Tons, Geneva, Utah, building for Geneva Steel Co. to American Bridge Co., Pittsburgh.

700 Tons, De Soto, Mo., car fabricating shop for Missouri Pacific R.R. to Bethlehem Steel Co., Bethlehem, Pa.

500 Tons, Baltimore, highway bridge over Wise Ave., McClane Contracting Co. low bidder.

450 Tons, Whiting, Ind., welding and machine shop for Standard Oil Co. to J. T. Ryerson & Son, Chicago.

275 Tons, Escondido, Calif., bridge across Santa Ysabel Creek, through Spencer Webb, to Bethlehem Pacific Coast Steel Corp., San Francisco.

225 Tons, Grand Coulee, Wash., traveling cranes for Grand Coulee Pumping Plant, Bureau of Reclamation, Denver, to Whiting Corp., Harvey, Ill.

150 Tons, Northampton, Mass., boiler house for Smith College to American Bridge Co., Pittsburgh, through George A. Fuller Co., Boston.

135 Tons, Dover, N. H., machine shop for Kidder Press Co. to Bethlehem Steel Co., Bethlehem, Pa.

130 Tons, Haywood, Mich., Wakefield Power House to Northwestern Boiler & Welding Co., Green Bay, Wis.

120 Tons, Oakland, Calif., addition to Children's Hospital, through E. J. Freethy, to Bethlehem Pacific Coast Steel Corp., San Francisco.

• • • **Fabricated steel inquiries** this week included the following:

5500 Tons, Kansas City, building for Loose Wiles Biscuit Co.

2100 Tons, Toledo, power house for Toledo Edison Co.

1500 Tons, Long Beach, Calif., girder rails for trackage on Pier "B," Long Beach Harbor, Spec. HD 220-A, bids open Nov. 26.

600 Tons, Bergen County, N. J., New Jersey Dept. of Highways, underpasses on Route S-3, Section 5, Dec. 3.

550 Tons, Terre haute, Ind., power plant No. 7, Sargant & Lundy, engineers.

265 Tons, Aurora, Ill., building, Independent Pneumatic Tool Co.

150 Tons, Pueblo, Col., Rock Creek bridge on State Highway 96, State Highway Engineer, Denver, bids open Nov. 29.

150 Tons, Villanova, Pa., roof steel for Villanova College, Dec. 2.

• • • **Reinforcing bar awards** this week included the following:

2750 Tons, Chicago, south side sewer to Carnegie-Illinois Steel Corp., through S. A. Healy Co., contractor.

250 Tons, Taos, N. M., bridge and paving on State Highway 3, between Questa and Taos, through Lowdermilk Bros. to Colorado Builders.

205 Tons, Seattle, garage and service station at 6th and Olive Way, through Sound Construction & Engineering Co. to Northwest Steel Rolling Mills, Seattle.

100 Tons, Escondido, Calif., bridge across Santa Ysabel Creek, through Spencer Webb to Bethlehem Pacific Coast Steel Corp., San Francisco.

• • • **Reinforcing bar inquiries** this week included the following:

1600 Tons, East Peoria, Ill., engine plant, Caterpillar Tractor Co.

395 Tons, Oakland, Calif., overhead structure over S.P.R.R. tracks and outer highway construction at Fruitvale Ave., California Div. of Highways, Sacramento.

375 Tons, Casper, Wyo., miscellaneous bars for Kortes Dam, Bureau of Reclamation, Denver, Inv. 19,526-A-1, bids open Nov. 29.

300 Tons, Selah, Wash., Central Washington Tuberculosis Hospital, John S. Maloney, Yakima, general contractor.

105 Tons, Chicago, 130th St. bridge.

• • • **Sheet piling awards** this week included the following:

32 Tons, Chicago, Cuneo Press Co., dock to Carnegie-Illinois Steel Corp. through Harry A. Thompson, contractor.

• • • **Rail inquiries** this week included the following:

3097 Tons, standard rails for the Havana Terminal R.R.

• • • **Railroad car awards** this week included the following:

The American Refrigerating Transit Co. has ordered 1800 40-ton refrigerator cars divided equally between Pullman-Standard Car Mfg. Co. and General American Transportation Co. The Atchison, Topeka & Santa Fe R.R. has ordered 250 50-ton box cars from Pullman Standard Car Mfg. Co.

• • • **Railroad car inquiries** this week included the following:

The Denver, Rio Grande and Western R.R. is inquiring for 300 to 500 50-ton drop-in gondolas. The Chesapeake & Ohio R.R. is inquiring for 227 passenger cars while the Nickel Plate R.R. is inquiring for 20 and the Pere Marquette for 26.

Expects Cancellation Of All Priority Ratings For Iron, Steel Items

Washington

• • • **Cancellation of all** priority ratings for iron and steel products was expected to be announced by CPA late this week. The action, vigorously opposed by Housing Expediter Wilson W. Wyatt could only be shelved if the coal strike came to a sudden end.

Meanwhile, it has been revealed that if ratings should continue their normal pattern, assuming the coal strike is of short duration, the first quarter of 1947 will find steel mills jammed with priority orders for sheet and strip to a greater extent than has been prevalent during the current confused quarter.

Reasons for the anticipated increase in the coming months are the fact that many rated orders will be carried over from the fourth quarter and the addition of more items to the schedule accompanying Direction 18 to Pr 28.

The conclusion that the first quarter 1947 mill schedules would resemble a "miniature Controlled Materials Plan" was reached at a 3-day meeting of the CPA Sheet and Strip Industry Advisory Committee.

At this meeting, CPA and the industry representatives agreed that the third quarter of 1946 be used as a base for authorizing first quarter 1947 sheet and strip steel under Direction 18, since this quarter was more normal than has been proven to be the case during the final three months of the year.

During the current quarter, approximately 80 pct of the authorized rated tonnage was placed without difficulty. The trouble that was encountered with the remaining 20 pct has been attributed, by CPA, mainly to the fact that these customers had no regular sources of supply.

MACHINE TOOLS

. . . News and Market Activities

Unfilled Orders Continue Downward Trend

• • • **Continuing their** gradual downward trend, unfilled orders in the machine tool industry receded to $175,512,628 at the end of October, based on a preliminary report compiled by the National Machine Tool Builders' Assn. from reports submitted by 182 producers.

In July, the month partial price decontrol became effective, the backlog stood at $185,058,204. In August, the downward trend began, and even with some price increases, unfilled orders dropped to $182,438,263. Unfilled orders at the end of September amounted to $179,796,543.

While some slight upward revision is probably in order after all reports are in, the unfilled order trend substantiates predictions of qualified observers that the industry is in for a grim time. These same observers are also on record that the full effect of the low-priced surplus will be felt about the first of the year.

Some machine tool builders have taken a strong stand on the price-raising pattern, and have announced that no increase will be made for six months, thus invalidating the escalator clauses which their contracts have been carrying. Other companies, despite the clamor of their cost departments, are resisting as long as possible. Most important of all is the fact that a number of major producers are shipping more machines than they are selling, and the backlog is in for a whittling.

October shipments of $28,935,000 were the best since June, when the industry shipped $28,580,000, which may reflect the improvement in the component parts situation, particularly electrical equipment. However, only in January when shipments totaled $30,263,000, has the industry as a whole managed to measure up to the $30,000,000 yardstick.

One of the bright spots at the moment is the progress being made toward establishing a strategic reserve of machine tools by the armed forces. Present indications are that about 60,000 machines will be turned into a stand-by pool for any future emergency. The Bureau of Aeronautics of the Navy will take about 16,000 machines; the Army Air Forces about 24,000 and Army Ordnance Department about 19,000.

It is likely that the armed forces will have some difficulty in locating, and in fact, obtaining the machines they want. The AAF is already on the job tagging machines in some WAA warehouses, but in view of the condition imposed that no machines necessary to reconversion can be put into stand-by, and due to the picking over that the surplus has already been subjected to, some observers believe that the total number so appropriated will not exceed 50,000 machines.

Other observers feel that the armed forces should, if possible, set up a stand-by pool of about 10 pct of the wartime machines, or about 100,000 units, and then inventory the pool every other year to weed out those machines which changes in war material has rendered unnecessary. This is a sound scheme but there is probably very little chance of its being put in action, according to some sources.

In Cincinnati, reliable sources in the trade report a definite slump in ordering. Both foreign and domestic buying is off and some observers indicate that they are accepting subcontracts in order to keep their employees working. The general feeling is that this is a temporary lull and business will again go up sharply in the coming year.

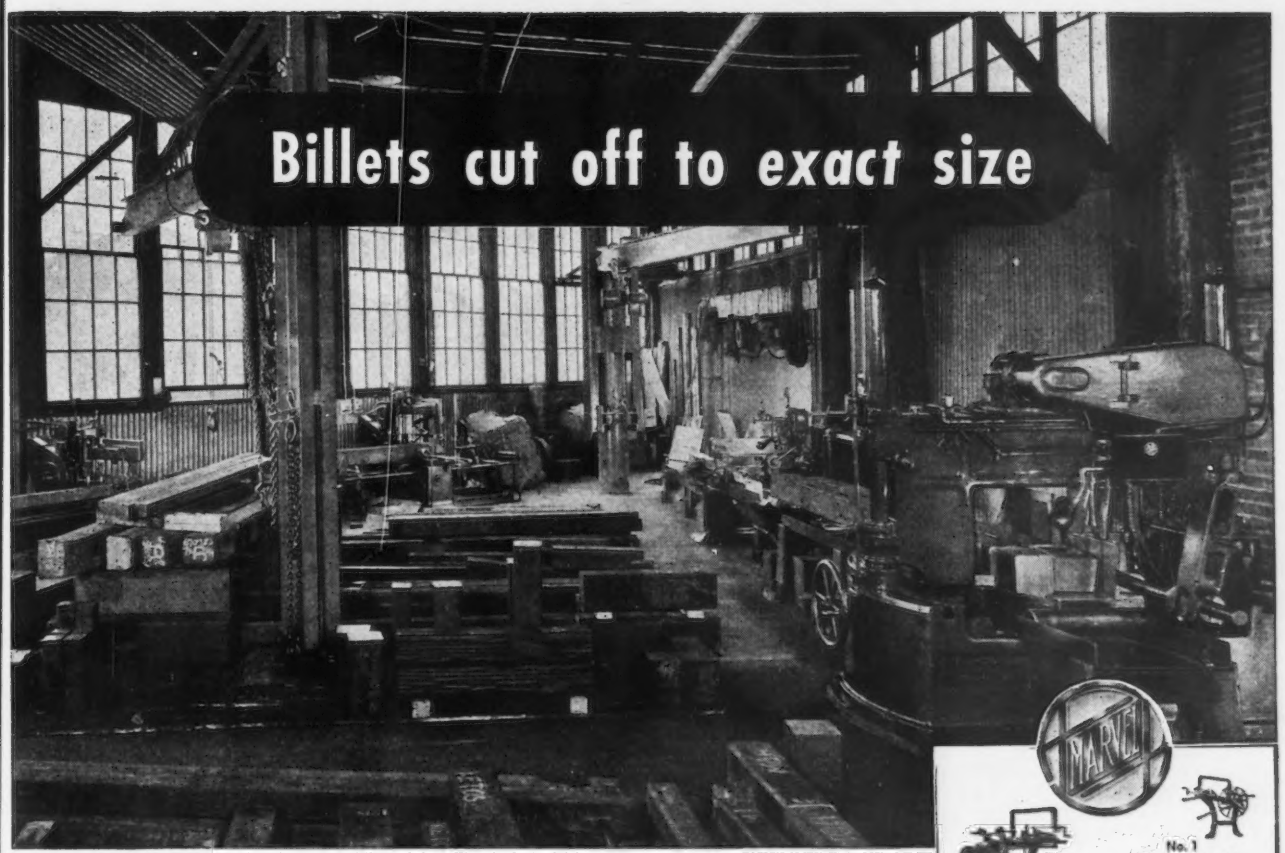
Most producers in the area report employment of more men and that more hours are being worked than in the prewar period, and every effort is being made on the part of management to maintain existing levels.

Possible embargoes caused by the coal situation will result in a delay in making foreign shipments, but so far as local machine tool production is concerned, unless the power company has to restrict the use of power, none of the builders in the Cincinnati area will be affected.

C. M. Doiseau, president, Blacrank, Inc., has announced formation of a new automotive parts division to manufacture automotive replacement parts under the Blacrank name. The division is now obtaining equipment and will start production early in 1947.

In Boston sales reports are mixed this week. Some manufacturers and representatives say business is running behind last month. Others report evidence of increased business activity in the near future. However, some sources in the trade are still able to report sales ahead of October, but in many of these cases, export business has been a factor. Some machine tool makers are producing machinery in addition to tools which have sold remarkably well and bolstered earnings.

By and large the trade does not take an optomistic view of things. However, on top of liberal offerings of surplus tools, the coal strike situation is sure to have its effect on metalworking business, according to the trade. While it is true surplus tools are not moving in volume anticipated by government, the fact that large numbers still overhang the market is not reassuring. However, builders expect new improvements will count heavily in making tools attractive to buyers.



ANY QUANTITY CUT-OFF AUTOMATICALLY

These MARVEL Saws are money makers for this modern forge shop in many ways. (1st) they cut off billets for a small fraction of the cost of cutting-off with a hammer. (2nd) these billets are so accurate in size that they exactly fill the dies with no excess fin, not only simplifying trimming and finishing, but getting extra billets from many bars. (3rd) they keep all hammers busy on *production* work for these "world's fastest" saws can keep ahead of any schedule. (4th) they reduce cutting-off labor costs to an absolute minimum. It takes only one operator and a helper to keep all of these saws running because all but the No. 18 Giant Hydraulic Saw (at the right) are *automatic*-feed measure, and cut-off identical billets; requiring no more attention than automatic screw machines.

Your local MARVEL Sawing Engineer will gladly call and explain how you can add these five extra profits to your forge operation.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVE. **CHICAGO 39, U. S. A.**

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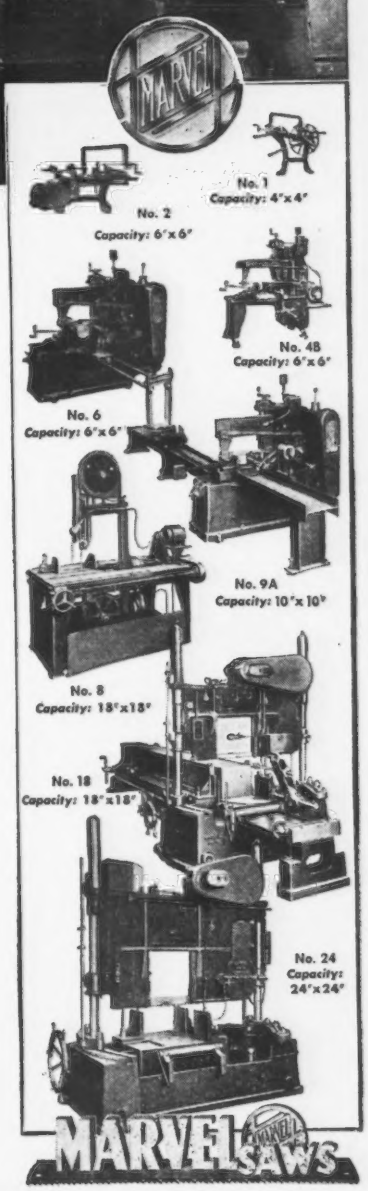


MARVEL SAWS

NONFERROUS METALS

. . . News and Market Activities

RFC Ends Purchases Of Foreign Copper

Washington

• • • **Effective immediately,** CPA on Nov. 19 issued orders terminating all public purchases of copper by RFC through the Office of Metals Reserve except for outstanding commitments. The action was an aftermath of price decontrol.

For the present, CPA announced, allocations will continue to be made for urgent needs from the dwindling government stockpile.

While the amount of government commitments was not disclosed, the 1946 public purchase program was originally established at 300,000 tons of which 180,000 tons have been received. Deficits to date between domestic supply and demand have been met principally by withdrawals from government stocks.

Industrial demand, however, is currently running at a rate in excess of the indicated annual supply, including scrap, of nearly 1,000,000 tons as against prewar peak requirements of about 800,000 tons, according to CPA figures.

In addition, government copper stocks which stood at around 500,000 tons at the beginning of 1946 have now been reduced to about 160,000 tons. CPA is likely to screen carefully all demands before releasing any appreciable quantities.

•

To Continue Tin Purchase

Washington

• • • **Government purchases** of tin will be continued at least through the first quarter of 1947, it has been announced by the CPA, thus setting to rest rumors of tin decontrol which followed the termination of public buying of lead and copper. Also, all other controls will be exercised for the same period.

In addition to public purchasing, the controls which will remain in effect through March 31 are the import restrictions as contained in Order M-63 and the domestic use and quota controls set forth under the tin order, M-43.

•

Increase Nickel Prices

New York

• • • **The International Nickel** Co. has announced a price increase on electrolytic nickel to contract customers, effective Nov. 25. The contract price has been increased to 35¢ per lb f.o.b. Port Colborne, without freight allowance as compared to the former price of 32¢ less ½¢ freight allowance. This price is for 99.9 pct nickel and represents the first price change in nickel since 1925.

The price for spot nickel sales in smaller quantities from distributors' warehouses has not yet been established.

President Robert C. Stanley has also announced a new product identified as nickel oxide sinter to be offered for alloying of steel at a lower cost than involved in the use of electrolytic nickel.

•

WAA Revises Price Policy

Washington

• • • **Under a change** in pricing policy, WAA has offered for sale, on a competitive bid basis its entire stock of $100 million worth of surplus nonferrous metals. Previously, these metals were offered at fixed prices in accordance with OPA ceilings.

Among the metals affected by the price change are copper, lead, tin, zinc and their alloys, in all shapes and forms. Inventories of one carload or less will be offered as a single lot; inventories up to 1,000,000 lbs will be offered in 100,000 lb lots; and over 1,000,000 lbs, in 250,000 lb lots.

A certain amount of surplus aluminum and magnesium is being reserved from this action. Scrap and other raw materials included in the CPA declaration of civilian deficiency will continue to be sold on a sealed bid basis as in the past.

•

Raise Copper to 19.50¢

New York

• • • **Lead off by** the Phelps Dodge Copper Co., all copper producers have increased prices of electrolytic copper 2¢ to 19.50¢ per lb, delivered Connecticut Valley. This represents the second price increase since decontrol and there are expectations among the industry that another increase of approximately 2¢ may be anticipated soon.

•

Increase Lead Quotas

Washington

• • • **Anticipating an** increase in the supply of secondary lead as a result of the lifting of price ceilings, CPA has increased four quarter lead quotas for producers of replacement storage batteries, lead chemicals and cable covering.

Lead may now be used for replacement batteries up to 86 pct of the third quarter quota, an increase of 6 pct. Lead usage for cable covering has been increased to 22 pct of the base period, an increase of 2 pct. Producers of lead chemicals have received a 10 pct increase.

•

To Ship Aluminum Pig From U. S. German Zone

Washington

• • • **An estimated** 25,000 tons of aluminum pig, melted from scrap material in the American zone in Germany, is expected to be shipped to the United States, according to the first November report of the American Military Government.

Nonferrous Metals Prices

Cents per pound

	Nov. 20	Nov. 21	Nov. 22	Nov. 23	Nov. 25	Nov. 26
Copper, electro., Conn.	19.50	19.50	19.50	19.50	19.50	19.50
Copper, Lake, Conn.	19.50	19.50	19.50	19.50	19.50	19.50
Tin, Straits, New York	70.00	70.00	70.00	....	70.00	70.00
Zinc, East St. Louis	10.50	10.50	10.50	10.50	10.50	10.50
Lead, St. Louis	13.35	10.35	10.35	10.35	11.65	11.65

Primary Metals

(Cents per lb, unless otherwise noted)

Aluminum, 99+%, f.o.b. shipping point (min. 10,000 lb)	15.00
Aluminum pig, f.o.b. shipping point	14.00
Antimony, American, Laredo, Tex.	23.50
Beryllium copper, 3.75-4.25% Be; dollars per lb contained Be	$14.75
Beryllium aluminum, 5% Be; dollars per lb contained Be	$30.00
Cadmium, del'd	$1.25 to $1.50
Cobalt, 97-99% (per lb)	$1.50 to $1.57
Copper, electro, Conn. Valley	19.50
Copper, electro, New York	19.25
Copper, lake, Conn. Valley	19.50
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.8%, dollars per troy oz.	$2.25
Iridium, dollars per troy oz.	$125.00
Lead, St. Louis	11.65
Lead, New York	11.80
Magnesium, 99.8 + %	20.50
Magnesium, sticks, carlots	36.00
Mercury, dollars per 76-lb flask, f.o.b. New York	$92 to $94
Nickel, electro, f.o.b. refinery	35.00
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per troy oz.	$69 to $72
Silver, New York, cents per oz.	90.125
Tin, Straits, New York	70.00
Zinc, East St. Louis	10.50
Zinc, New York	10.94
Zirconium copper, 6 pct Zr, per lb contained Zr	$ 6.00

Remelted Metals

Brass Ingot

(Cents per lb, in carloads)

85-5-5-5 ingot	
No. 115	20.50
No. 120	20.00
No. 123	19.50
80-10-10 ingot	
No. 305	23.50
No. 315	22.00
88-10-2 ingot	
No. 210	25.75
No. 215	24.75
No. 245	21.75
Yellow ingot	
No. 405	16.25
Manganese Bronze	
No. 421	18.25

Aluminum Ingot

(Cents per lb, lots of 30,000 lb)

95-5 alum.-sil. alloys:	
0.30 copper, max.	17.00
0.60 copper, max.	16.75
Piston alloys (No. 122 type)	15.50—15.75
No. 12 alum. (No. 2 grade)	15.50
108 alloy	15.50—16.00
195 alloy	16.25
AXS-679	15.75—16.00
Steel deoxidizing aluminum, notch-bar, granulated or shot.	
Grade 1—95 pct-97½ pct	16.25
Grade 2—92 pct-95 pct	15.75
Grade 3—90 pct-92 pct	15.50
Grade 4—85 pct-90 pct	15.00

Electroplating Supplies

Anodes

(Cents per lb, f.o.b. shipping point in 500 lb lots)

Copper, frt. allowed	
Cast, oval, 15 in. or longer	36⅞
Electrodeposited	30⅝
Rolled, oval, straight delivered	31⅛
Curved, 18 in. or longer, delivered	31⅛
Brass, 80-20, frt allowed	
Cast oval, 15 in. or longer	33⅜
Zinc, Cast, 99.99	18¾
Nickel, 99 pct plus, frt allowed	
Cast	47
Rolled, depolarized	48
Silver, 999 fine	
Rolled, 1000 oz lots, per oz	93⅞

Chemicals

(Cents per lb, f.o.b. shipping point)

Copper cyanide, 1-5 bbl	20.50
Copper sulphate, 99.5, crystals, bbls	7.75
Nickel salts, single, 425 lb bbls, frt allowed	13.50
Silver cyanide, 100 oz lots, per oz	0.749
Sodium cyanide, 96 pct, domestic, 125 lb drums	15.00
Zinc cyanide, 100 lb drums	33.00
Zinc, sulphate, 89 pct, crystals, bbls, frt allowed	.0635

Mill Products

Aluminum

(Cents per lb, base, subject to extras for quantity, gage, size, temper and finish)

Drawn tubing: 2 to 3 in. OD by 0.065 in. wall: 3S, 43.5¢; 52S-O, 67¢; 24S-T, 71¢; base, 30,000 lb.

Plate: ¼ in. and heavier: 2S, 3S, 21.2¢; 52S, 24.2¢; 61S, 23.8¢; 24S, 24S-AL, 24.2¢; 75S, 75S-AL, 30.5¢; base, 30,000 lb.

Flat Sheet: 0.136-in. thickness: 2S, 3S, 23.7¢; 52S, 27.2¢; 61S, 24.7¢; 24S-O, 24S-OAL, 26.7¢; 75S-O, 75S-OAL, 32.7¢; base, 30,000 lb.

Extruded Solid Shapes: factor determined by dividing the perimeter of the shape by its weight per foot. For factor 1 through 4, 3S, 26¢; 14S, 32.5¢; 24S, 35¢; 53S, 61S, 28¢; 63S, 27¢ 75S, 45.5¢; base, 30,000 lb.

Wire, Rod and Bar: screw machine stock, rounds, 17S-T, ¼ in., 29.5¢; ½ in., 37.5¢; 1 in., 26¢; 2 in., 24.5¢; hexagons, ¼ in., 35.5¢; ½ in., 30¢; 1in., 2 in., 27¢; base, 5000 lb. *Rod:* 2S, 3S, 1¼ to 2½ in. diam, rolled, 23¢; cold-finished, 23.5¢ base, 30,000 lb. *Round Wire:* drawn, coiled, B & S gage 17-18: 2S, 3S, 33.5¢; 56S, 39.5¢; 10,000 lb base; B & S gage 00-1: 2S, 3S, 21¢; 56S, 30.5¢. B & S 15-16: 2S, 3S, 32.5¢; 56S, 38¢; base, 30,000 lb.

Magnesium

(Cents per lb, f.o.b. mill)

Sheet and Plate: Ma, FSa, ¼ in.,54¢-56¢; 0.188 in., 56¢-58¢; B & S gage 8, 58¢-60¢; 10, 59¢-61¢; 14, 69¢-74¢; 16, 79¢-81¢; 18, 87¢-89¢; 22, $1.25-$1.31; 24, $1.71-$1.75. Base quantity, 30,000 lb.

Round Rod: M, diam in. ⅛, 55¢; ¼, 47¢; ⅜, 46¢; ½, 45¢; ¾, 44¢; 1¾, 43.5¢; 2, 42.5¢; 3, 41.5¢; 4, 42.5¢ 5, 43.5¢; 6 & 7 in., 44¢. Base price, 5000-10,000 lb.

Square and Hexagonal Bar: M, diam in. ¼, 58¢; ¼, 50¢; ⅜, 48¢; ½, 47.5¢; ¾, 46.5¢; 1¾, 45.5¢; 2, 44.5¢; 3, 43.5¢; 4 & 5 in. 44.5¢; 6 & 7 in., 45¢. Base quantity, 5000-10,000 lb.

Tubing: Varies with wall thickness and outside diameter.

Nickel and Monel

(Cents per lb, f.o.b. mill)

	Nickel	Monel
Sheets, cold-rolled	49	39
No. 35 sheets	..	37
Strip, cold-rolled	55	40
Rod		
Hot-rolled	45	35
Cold-drawn	50	40
Angles, hot-rolled	45	35
Plates	47	37
Seamless tubes	75	65
Shot and blocks	..	28

Zinc

(Cents per lb, f.o.b. mill)

Sheet, l.c.l.	15.40
Ribbon, ton lots	14.50
Plates	
Small	13.25
Large, over 12 in.	14.25
Lithographic, engrained	17.25

Copper and Brass

Sheets

(Cents per lb)

Yellow brass	27.53
Commercial bronze	30.56
Copper in rolls	29.21
Soft sheet copper	30.93

Wire and Rods

Yellow brass wire	27.82
Yellow brass (free cutting) rod	22.28
Yellow brass rod	27.22
Drawn copper rod	28.28

Seamless Tubes

Yellow brass	30.29
Copper	30.97

Scrap Allowance

Yellow brass	13.75
Copper	17.125
Yellow brass turnings	12.875

Scrap Metals

(Dealers' buying prices, f.o.b. New York)

Copper and Brass

(Cents per lb)

No. 1 heavy copper and wire	14¾—15¼
No. 2 heavy copper and wire	13¾—14¼
Light copper	12¼—12¾
Auto radiators (unsweated)	12 —12¼
No. 1 composition	14¼—14¾
No. 1 composition turnings	13¼—13¾
Clean red car boxes	11 —11½
Clocks and faucets	11½—12
Mixed heavy yellow brass	9½—10
Old rolled brass	8¾— 9¼
Brass pipe	10¼—10¾
New soft brass clippings	11 —11½
Brass rod ends	9¾—10¼
No. 1 brass rod turnings	10 —10½

Aluminum

(Cents per lb)

Alum. pistons with struts	4½— 5
Aluminum crankcases	7¼— 7½
2S aluminum clippings	8 — 8¼
Old alum. Sheet & utensils	7½— 8
Mixed alum. borings and turnings	2 — 2¼
Misc. cast aluminum	7 — 7½
Dural clips (24S)	6 — 6½

Zinc

(Cents per lb)

New zinc clippings	7 — 7½
Old zinc	5¼— 5¾
Zinc routings	3 — 3⅛
Old die cast scrap	3 — 3¼

Nickel and Monel

(Cents per lb)

Pure nickel clippings	18 —19
Clean nickel turnings	14 —15
Nickel anodes	16½—17½
Nickel rod ends	17 —18
New Monel clippings	15 —16
Clean Monel turnings	10 —10½
Old sheet Monel	12 —12½
Old Monel castings	10 —11
German silver clippings, mixed	10½—11
German silver turnings, mixed	7 — 7¼

Lead

(Cents per lb)

Soft scrap lead	9½—10
Battery plates (dry)	5¼— 5½

Miscellaneous

(Cents per lb)

Block tin	60 —
No. 1 pewter	46 —48
No. 1 auto babbitt	36 —37
Mixed common babbitt	12 —12½
Solder joints	13
Siphon tops	30 —32
Small foundry type	15 —15½
Monotype	12½—13
Lino and stereotype	12 —12½
Electrotype	10 —10½
New type shell cuttings (nom.)	11 —11½
Clean hand picked type shells	5 — 5½
Lino and stereo dross	5½— 6
Electro dross	3½— 4

Lead Products

(Cents per lb)

F.o.b. shipping point freight collect. Freight equalized with nearest free delivery point.

Full lead sheets	14.90
Cut lead sheets	15.40
Lead pipe, manufacturing point	14.15
Lead traps and bends	List +33 1/3%
Combination lead and iron bends and ferrules, also combination lead and iron ferrules	List +33 1/3%
Drum traps, U.S. list	List +33 1/3%
Montclair traps	List +33 1/3%
Lead burned bath traps	List +60%
Lead wool	16.30
Calking lead	13.30

SCRAP

Consumers Resisting Higher Prices

New York

• • • **Resistance to increases** of more than $5 a ton for heavy melting scrap continued to be felt in the trade during the past week. It is reported that a large railroad list, eagerly awaited as a gage of price trends, went for the going figures. Outside of this there have been some rises on cast grades in various districts.

Overall volume showed a little improvement in both steelmaking and iron foundry grades, the latter coming out in somewhat better volume due to far more substantial price rises over the past few weeks.

While large consumers appear to be successfully resisting anything more than a $5 increase for openhearth scrap, they are continuing to pay springboards to bring in material from remote points so that quoted prices, while applying in the various districts, do not reflect long haul freight which some consumers are being forced to pay for scrap generated at some distance from their plants.

No significant effects of the coal crisis have yet been felt in the nation's scrap centers. There is some question as to whether mills may go after scrap to replace pig iron as that item feels the effect of the strike or whether a rail embargo will so hamstring steelmaking as to cause a lessening of scrap demand.

The price increase in openhearth grades in Chicago is based on open orders on brokers by mills good until Dec. 5 in which it is reported that a large tonnage is involved.

•

PITTSBURGH—The failure of Pennsylvania Railroad officially to disclose its scrap sales as late as Monday left the market here without very much of a gage on prices. On the railroad list, bids are known to have been entered at better than $31 a ton on railroad heavy melting, but the only reported award on this list was for this grade at $26.00. The consumers seem to be holding the line pretty well on openhearth grades but the cast grades are spiraling because of the big iron shortage. The scrap prices as quoted still do not include freight, since no buyers are taking scrap on a delivered basis. Actually, the average delivered price of No. 1 in Pittsburgh is closer to $28.00 to $28.50, with specific prices ranging much higher as the scrap is brought into the district from remote points.

CHICAGO—Scrap volume remains fair and material continues to springboard from outlying areas. The increase in cast prices this week is due to foundries who were forced to buy. Most of the industry believes these prices will ease as the consumers become less desperate. With the strike forcing down operations the market is fast resolving around the dealers where most of the activity will take place as the strike goes on.

•

PHILADELPHIA—Railroad scrap offered by a southern road at the equivalent of what would be upwards of $32 delivered Pittsburgh has been rejected by three large consumers it is reported by the trade. Dealers report that scrap is moving in slightly large volume. Dealers believe that the effects of the coal strike will for a time improve the market for scrap because of the increased scrap charges which will be used in the openhearth due to the pig iron shortage. It should eventually cause a curtailment of shipments when a freight embargo goes into effect, but in view of the overall shortage the market is expected to remain firm.

•

NEW YORK—A slight improvement in shipments of openhearth steel scrap is reported this week from this area. Cast grades are also moving better now that higher prices have made searching around somewhat more profitable. A spokesman for Luria Bros. denied that his office had given out a report to a local paper implying that the price of No. 1 heavy melting steel was $30 delivered at Pittsburgh. Early this week there was no indication that mills were willing to go overboard to build up scrap supplies in anticipation of reduced hot metal.

•

DETROIT—Automotive lists issued by Fisher Body, Chevrolet, Hudson, Willys-Overland, A. C. Spark Plug and others will close this week but until bids are accepted it will be difficult to determine the position of the Detroit scrap market. Possibly with the effect of the coal strike in mind, large Detroit buyers have been slow at coming into the market. There are indications that scrap movements will be on a restricted basis until the first large sales are consummated and the coal strike reaches a solution.

•

CLEVELAND — Backed by plenty of pressure from major consumers, the $5 formula is being generally held, while the foundry grades are following no particular price line. Long freight hauls are not disturbing the market prices, although some consumers are paying lower springboards than they did under OPA. Others have not been able to do so. The cast supply situation is somewhat improved, but with many foundries slated to go down for lack of coal, by next week the buying in many cases will be for stockpiles. Further scrap price increases are expected to come simultaneously with bad weather, but tonnages moved at prices higher than formula thus far have not been significant.

•

BOSTON—Heavy breakable cast generally is $35 a ton, but $40 a ton is the going market for other kinds of cast, and apparently anything goes at that price. Turnings and chemical boring values are more defined than a week ago and higher. Yard stocks and shipments of all other grades of scrap are discouragingly low, with a few speculatively minded yardsmen holding for higher prices.

•

BUFFALO—The light end of the scrap list advanced $2.50 a ton this week to make it a uniform $5 increase over the old ceilings for all openhearth and blast furnace grades. Machine shop turnings sold at $19.25 and short shovelings at $21.25. Indications that there would be no immediate holdup in shipments to mills because of curtailed operations had a heartening effect on trade sentiment. Cast scrap prices were highly irregular, with scattered small sales reported as high as $35 to foundries in distress, but the leading consumers refused to pay more than $28.50. Yards in the switching district actually get only $23.89, plus 36¢ freight.

•

CINCINNATI—By and large prices of iron and steel scrap in this area have been straightened out at a general average of about $5.00 above the former OPA price ceiling, but, so far, no definite scales have been reported, as a definite test on prices. Availability of scrap continues to be a very serious problem, and dealers and brokers are seeking supplies wherever they can be located. Some tonnage was released by higher prices, but there is still not a sufficient amount coming out to meet demands.

•

TORONTO — General shortage of steel making scrap and acute scarcity of iron scrap materials are dominating features of the present markets. The improvement in offerings of industrial scrap has been more than offset by slowing down of deliveries from rural communities, western Canada and the mining centres, with the result that current receipts are only around 35 pct of actual requirements. Users of cast scrap and stove plate have given up hope of obtaining large supplies of these materials and do not look for improvement in present conditions for some months into the future.

Rust to Build Power Plant for Roebling

Pittsburgh

• • • **The Rust Engineering Co.,** Pittsburgh, Pa., announced it had been awarded a contract to design and construct a new power plant, costing in excess of $1,000,000, for John A. Roebling's Sons Co., Roebling, N. J.

IRON AND STEEL SCRAP PRICES

Going prices as obtained in the trade by IRON AGE editors, based on representative tonnages. Pending establishment of a market in some districts and in certain grades, the former OPA ceiling price is inserted for reference, followed by an asterisk.

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. melting	$25.00 to $25.50
RR. hvy. melting	26.00 to 26.50
No. 2 hvy. melting	25.00 to 25.50
RR. scrap rails	26.50 to 27.00
Rails 3 ft. and under	28.50 to 29.00
No. 1 comp'd bundles	25.00 to 25.50
Hand bdld. new shts.	25.00 to 25.50
Hvy. axle turn.	24.50 to 25.00
Hvy. steel forge turn.	24.50 to 25.00
Mach. shop turn.	20.00 to 20.50
Short shov. turn.	22.00 to 22.50
Mixed bor. and turn.	20.00 to 20.50
Cast iron borings	20.00 to 20.50
No. 1 cupola cast	32.50 to 34.00
Heavy breakable cast	26.00 to 26.50
Malleable	27.50 to 28.00
RR. Knuck, and coup.	30.00 to 30.50
RR. coil springs	30.00 to 30.50
Rail leaf springs	30.00 to 30.50
Rolled steel wheels	30.00 to 30.50
Low phos.	27.50 to 28.00

CHICAGO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$25.00 to $25.50
No. 2 hvy. melting	25.00 to 25.50
No. 1 bundles	25.00 to 25.50
No. 2 dealers' bndls.	25.00 to 25.50
Bundled mach. shop turn.	25.00 to 25.50
Galv. bundles	21.50 to 22.00
Mach. shop turn.	17.25 to 17.75
Short shovels, turn.	19.25 to 19.75
Cast iron borings	16.75 to 17.25
Mix. borings & turn.	17.25 to 17.75
Low phos. hvy. forge	28.00 to 30.00
Low phos. plates	26.50 to 27.50
No. 1 RR. hvy. melt.	26.50
Reroll rails	33.00 to 33.50
Miscellaneous rails	33.00 to 33.50
Angles & splice bars	28.50 to 29.00
Locomotive tires, cut	24.25*
Cut bolsters & side frames	28.50 to 29.00
Standard stl. car axles	29.50 to 30.00
No. 3 steel wheels	28.50 to 29.00
Couplers & knuckles	28.50 to 29.00
Malleable	35.00 to 40.00
No. 1 mach. cast	37.50 to 42.00
Rails 3 ft. and under	32.00 to 32.50
No. 1 agricul. cast	30.00 to 35.00
Hvy. breakable cast	30.00 to 35.00
RR. grate bars	31.50 to 32.00
Cast iron brake shoes	30.25 to 30.50
Stove plate	33.50 to 34.00
Clean auto cast	27.00*
Cast iron carwheels	30.50 to 31.00

CINCINNATI

Per gross ton delivered to consumer:

Cast grades f.o.b. shipping point

No. 1 hvy. melting	$23.70
No. 2 hvy. melting	23.70
No. 1 bundles	23.70
No. 2 bundles	23.70
Mach. shop turn.	$15.50 to 16.00
Shoveling turn.	17.50 to 18.00
Cast iron borings	16.50 to 17.00
Mixed bor. & turn.	16.50 to 17.00
Low phos. plate	27.00
No. 1 cupola cast	30.00
Hvy. breakable cast	25.00
Stove plate	28.00
Scrap rails	26.00

BOSTON

Dealers' buying prices per gross ton, f.o.b. cars

No. 1 hvy. melting	$20.35
No. 2 hvy. melting	20.35
Nos. 1 and 2 bundles	20.35
Busheling	20.35
Turnings, shovelings	$17.00 to 17.35
Machine shop turn.	15.00 to 15.35
Mixed bor. & turn.	15.00 to 15.35
Cl'n cast, chem. bor.	16.50 to 17.00
No. 1 machinery cast	40.00
No. 2 machinery cast	40.00
Breakable cast.	35.00
Stove plate	40.00

DETROIT

Per gross ton, brokers' buying prices:

No. 1 hvy. melting	$22.32
No. 2 hvy. melting	22.32
No. 1 bundles	22.32
New busheling	22.32
Flashings	22.32
Mach. shop turn	17.32
Short shov. turn	19.32
Cast iron borings	18.32
Mixed bor. & turn.	17.32
Low phos. plate	24.82
No. 1 cupola cast.	$35.00 to 40.00
Charging box cast	30.00 to 32.00
Hvy. breakable cast	29.00 to 31.00
Stove plate	33.00 to 35.00
Automotive cast.	35.00 to 40.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. melting	$24.00 to $25.00
No. 2 hvy. melting	24.00 to 25.00
No. 1 bundles	24.00 to 25.00
No. 2 bundles	24.00 to 25.00
Mach. shop turn.	18.75 to 19.25
Shoveling turn.	21.25 to 21.75
Cast iron borings	18.75 to 19.25
Mixed bor. & turn.	18.75 to 19.25
No. 1 cupola cast	40.00 to 41.00
Hvy. breakable cast	35.00 to 36.00
Cast. charging box	36.00 to 37.00
Clean auto cast	40.00 to 41.00
Hvy. axle forge turn.	23.25 to 23.75
Low. phos. plate	26.50 to 27.50
Low phos. punchings	26.50 to 27.50
RR. steel wheels	26.50 to 27.50
RR. coil springs	26.50 to 27.50
RR. malleable	34.00 to 35.00

ST. LOUIS

Per gross ton delivered to consumer:

No. 1 hvy. melting	$22.50
Bundled sheets	22.50
Mach. shop turn.	15.50
Locomotive tires, uncut.	23.50
Misc. std. sec. rails	24.00 to 24.50
Rerolling rails	26.00 to 26.50
Steel angle bars	24.00 to 24.50
Rails 3 ft. and under	26.50 to 27.00
RR. springs	26.50 to 27.00
Steel car axles	29.50 to 30.00
Stove plate	25.00 to 27.00
Grate bars	25.00
Brake shoes	20.25
Malleable	29.00 to 29.50
Cast iron carwheels	27.00 to 27.50
No. 1 mach'ery cast.	30.00 to 32.50
Breakable cast.	25.00

BIRMINGHAM

Per gross ton delivered to consumer:

No. 1 hvy. melting	$22.00 to $22.50
No. 2 hvy. melting	22.00 to 22.50
No. 2 bundles	22.00 to 22.50
No. 1 busheling	22.00 to 22.50
Long turnings	15.00 to 16.00
Shoveling turnings	15.00 to 16.00
Cast iron borings	14.00 to 15.00
Bar crops and plate	19.50*
Structural and plate	19.50*
No. 1 cast	25.00 to 27.50
Stove plate	23.00*
Steel axles	18.50*
Scrap rails	18.50
Rerolling rails	20.50*
Angles & splice bars	21.00*
Rails 3 ft & under	21.00*
Cast iron carwheels	22.00*

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. melting	$25.00 to $25.50
No. 2 hvy. melting	25.00 to 25.50
Low phos. plate	27.50 to 28.00
No. 1 busheling	23.00 to 23.50
Hydraulic bundles	25.00 to 25.50
Mach. shop turn.	20.00 to 20.50
Short. shovel. turn.	22.00 to 22.50
Cast iron borings	21.00 to 21.50

NEW YORK

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	$20.33
No. 2 hvy. melting	20.33
Comp. black bundles	20.33
Comp. galv. bundles	18.33
Mach. shop turn.	15.33
Mixed bor. & turn.	15.33
Shoveling turn.	17.33
No. 1 cupola cast	$34.00 to 35.00
Hvy. breakable cast.	25.00 to 27.00
Charging box cast	25.00 to 27.00
Stove plate	30.00 to 32.00
Clean auto cast.	30.00 to 32.00
Unstrip. motor blks.	25.00 to 27.00
Cl'n chem. cast bor.	19.33

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$24.25 to $24.75
No. 1 bundles	24.25 to 24.75
No. 2 bundles	24.25 to 24.75
No. 2 hvy. melting	24.25 to 24.75
Mach. shop turn.	18.75 to 19.25
Shoveling turn.	20.75 to 21.25
Cast iron borings	19.75 to 20.25
Mixed bor. & turn.	18.75 to 19.25
No. 1 cupola cast.	28.00 to 30.00
Charging box cast.	24.00 to 26.00
Stove plate	26.00 to 28.00
Clean auto cast	28.00 to 30.00
Malleable	29.00 to 29.50
Low phos. plate	27.00 to 29.00
Scrap rails	25.75 to 26.25
Rails 3 ft. & under	27.75 to 28.25
RR. steel wheels	28.75 to 29.25
Cast iron carwheels	27.00 to 27.50
RR. coil & leaf spgs.	28.75 to 29.25
RR. knuckles & coup.	28.75 to 29.25
No. 1 busheling	19.25*

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. melting	$24.50 to $25.00
No. 2 hvy. melting	24.50 to 25.00
Compressed sheet stl.	24.50 to 25.00
Drop forge flashings	24.00 to 24.50
No. 2 bundles	24.50 to 25.00
Mach. shop turn.	19.50 to 20.00
Short shovel.	21.50 to 22.00
No. 1 busheling	24.50 to 25.00
Steel axle turn.	24.00 to 24.50
Cast iron borings	20.50 to 21.00
Mixed bor. & turn.	19.50 to 20.00
No. 2 busheling	22.00 to 22.50
No. 1 machinery cast	34.50 to 35.00
Malleable	29.00 to 29.50
Railroad cast	25.00
Railroad grate bars	20.25
Stove plate	28.00
RR. hvy. melting	20.50*
Rails 3 ft. & under	28.00
Rails 18 in. & under	29.25
Rails for rerolling	28.00
Elec. furnace punch	24.00 to 24.50

SAN FRANCISCO

Per gross ton delivered to consumer:

Cast grade f.o.b. shipping point

No. 1 hvy. melting	$19.50
No. 2 hvy. melting	19.50
No. 2 bales	19.50
No. 3 bales	16.00
Mach. shop turn.	13.00
Elec. furn. 1 ft. und.	19.50*
No. 1 cupola cast.	25.00*
RR. hvy. melting	20.50

LOS ANGELES

Per gross ton delivered to consumer:

Cast grade f.o.b. shipping point

No. 1 hvy. melting	$19.50
No. 2 hvy. melting	19.50
No. 1 bales	19.50
No. 2 bales	19.50
No. 3 bales	16.00
Mach. shop turn.	13.00
No. 1 cupola cast	25.00
RR. hvy. melting	20.50

SEATTLE

Per gross ton delivered to consumer:

Cast grade f.o.b. shipping point

No. 1 & No. 2 hvy. melting	$17.00
Elec. furn. 1 ft. und.	17.00
No. 1 cupola cast	25.00*
RR. hvy. melting	16.00

HAMILTON, ONT.

Per gross ton delivered to consumer:

Cast grades f.o.b. shipping point

Heavy melting	$17.50*
No. 1 bundles	17.50*
No. 2 bundles	17.00*
Mixed steel scrap	15.50*
Rails, remelting	18.50*
Rails, rerolling	21.50*
Bushelings	13.00*
Mixed borings & turnings	12.50*
Electric furnace bundles	20.50*
Manganese steel scrap	20.00*
No. 1 cast	19.00*
Stove plate	17.50*
Car wheels, cast	19.50*
Malleable iron	16.00*

Comparison of Prices . .

Advances over past week in Heavy Type, declines in *Italics*. Prices are f.o.b. major basing points. The various basing points for finished and semifinished steel are listed in the detailed price tables.

Flat-Rolled Steel: (cents per pound)	Nov. 26, 1946	Nov. 19, 1946	Oct. 22, 1946	Nov. 27, 1945
Hot-rolled sheets	2.425	2.425	2.425	2.20
Cold-rolled sheets	3.275	3.275	3.275	3.05
Galvanized sheets (24 ga.)	4.05	4.05	4.05	3.70
Hot-rolled strip				
6-in and under	2.45	2.45	2.45	2.10
Over 6 in.	2.35	2.35	2.35	2.10
Cold-rolled strip	3.05	3.05	3.05	2.80
Plates	2.50	2.50	2.50	2.25
Plates, wrought iron	4.112	4.112	4.112	3.80
Stain's c-r strip (No. 302)	30.30	30.30	30.30	28.00
Tin and Ternplate: (dollars per base box)				
Tinplate, standard cokes..	$5.00	$5.00	$5.00	$5.00
Tinplate, electro (0.50 lb)	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (cents per pound)				
Merchant bars	2.50	2,50	2.50	2.25
Cold-finished bars	3.10	3.10	3.10	2.75
Alloy bars	2.92	2.92	2.92	2.70
Structural shapes	2.35	2.35	2.35	2.10
Stainless bars (No. 302).	25.97	25.97	25.97	24.00
Wrought iron bars	4.76	4.76	4.76	4.40
Wire and Wire Products: (cents per pound)				
Bright wire	3.05	3.05	3.05	2.75
Wire nails	3.75	3.75	3.75	2.90
Rails: (dollars per net ton)				
Heavy rails	$43.39	$43.39	$43.39	$43.00*
Light rails	49.18	49.18	49.18	45.00*
*per gross ton				
Semifinished Steel: (dollars per gross ton)				
Rerolling billets	$39.00	$39.00	$39.00	$36.00
Sheet bars	38.00	38.00	38.00	36.00
Slabs, rerolling	39.00	39.00	39.00	36.00
Forging billets	47.00	47.00	47.00	42.00
Alloy blooms, billets, slabs	58.43	58.43	58.43	54.00
Wire Rods and Skelp: (cents per pound)				
Wire rods	2.30	2.30	2.30	2.15
Skelp	2.05	2.05	2.05	1.90

*Pig Iron: (per gross ton)	Nov. 26, 1946	Nov. 19, 1946	Oct. 22, 1946	Nov. 27, 1945
No. 2 foundry, Phila.	$30.43	$30.43	$30.43	$27.59
No. 2, Valley furnace	28.50	28.50	28.50	25.75
No. 2, Southern, Cin'ti	27.80	27.80	27.80	26.19
No. 2, Birmingham	24.88	24.88	24.88	22.13
No. 2 foundry, Chicago†	28.50	28.50	28.50	25.75
Basic, del'd eastern Pa.	29.93	29.93	29.93	27.09
Basic, Valley furnace	28.00	28.00	28.00	25.25
Malleable, Chicago†	28.50	28.50	28.50	25.75
Malleable Valley	28.50	28.50	28.50	25.75
L. S. charcoal, Chicago	42.34	42.34	42.34	42.34
Ferromanganese‡	135.00	135.00	135.00	135.00

† The switching charge for delivery to foundries in the Chicago district is 60¢ per ton.
‡ For carlots at seaboard.
* Prices retroactive to May 29; the price increase should be reflected in THE IRON AGE Comparison of Prices table since June 4.

Scrap: (per gross ton)				
Heavy melt'g steel, P'gh.	$25.25	$25.25	$20.00	$20.00
Heavy melt'g steel, Phila.	24.50	24.50	18.75	18.75
Heavy melt'g steel, Ch'go	25.25	24.50	18.75	18.75
No. 1 hy. comp. sheet, Det.	22.32	22.32	17.32	17.32
Low phos. plate, Youngs'n	27.75	27.75	22.50	22.50
No. 1 cast, Pittsburgh	29.00	29.00	25.00	20.00
No. 1 cast, Philadelphia	40.50	39.00	25.00	20.00
No. 1 cast, Chicago	37.75	37.75	25.00	20.00
Coke, Connellsville: (per net ton at oven)				
Furnace coke, prompt	$8.75	$8.75	$8.75	$7.50
Foundry coke, prompt	8.50	8.50	8.50	9.00
Nonferrous Metals: (cents per pound to large buyers)				
Copper, electro., Conn.	19.50	17.50	14.375	12.00
Copper, Lake, Conn.	19.50	17.50	14.375	12.00
Tin, Straits, New York	70.00	70.00	52.00	52.00
Zinc, East St. Louis	10.50	10.50	9.25	8.25
Lead, St. Louis	11.65	11.65	8.10	6.35
Aluminum, virgin	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony, Laredo, Tex.	23.50	23.50	14.50	14.50

Composite Prices . .

Starting with the issue of Apr. 22, 1943, the weighted finished steel index was revised for the years 1941, 1942 and 1943. See explanation of the change on p. 90 of the Apr. 22, 1943, issue. Index revised to a quarterly basis as of Nov. 16, 1944; for details see p. 98 of that issue. The finished steel composite prices for the current quarter are an estimate based on finished steel shipments for the previous quarter. These figures will be revised when the actual data of shipments for this quarter are compiled.

	FINISHED STEEL	PIG IRON	SCRAP STEEL
Nov. 26, 1946	2.70711¢ per lb.	$28.13 per gross ton.	$25.00 per gross ton.
One week ago	2.70711¢ per lb.	$28.13 per gross ton.	$24.75 per gross ton.
One month ago	2.70711¢ per lb.	$28.13 per gross ton.	$19.17 per gross ton.
One year ago	2.44104¢ per lb.	$25.37 per gross ton.	$19.17 per gross ton.

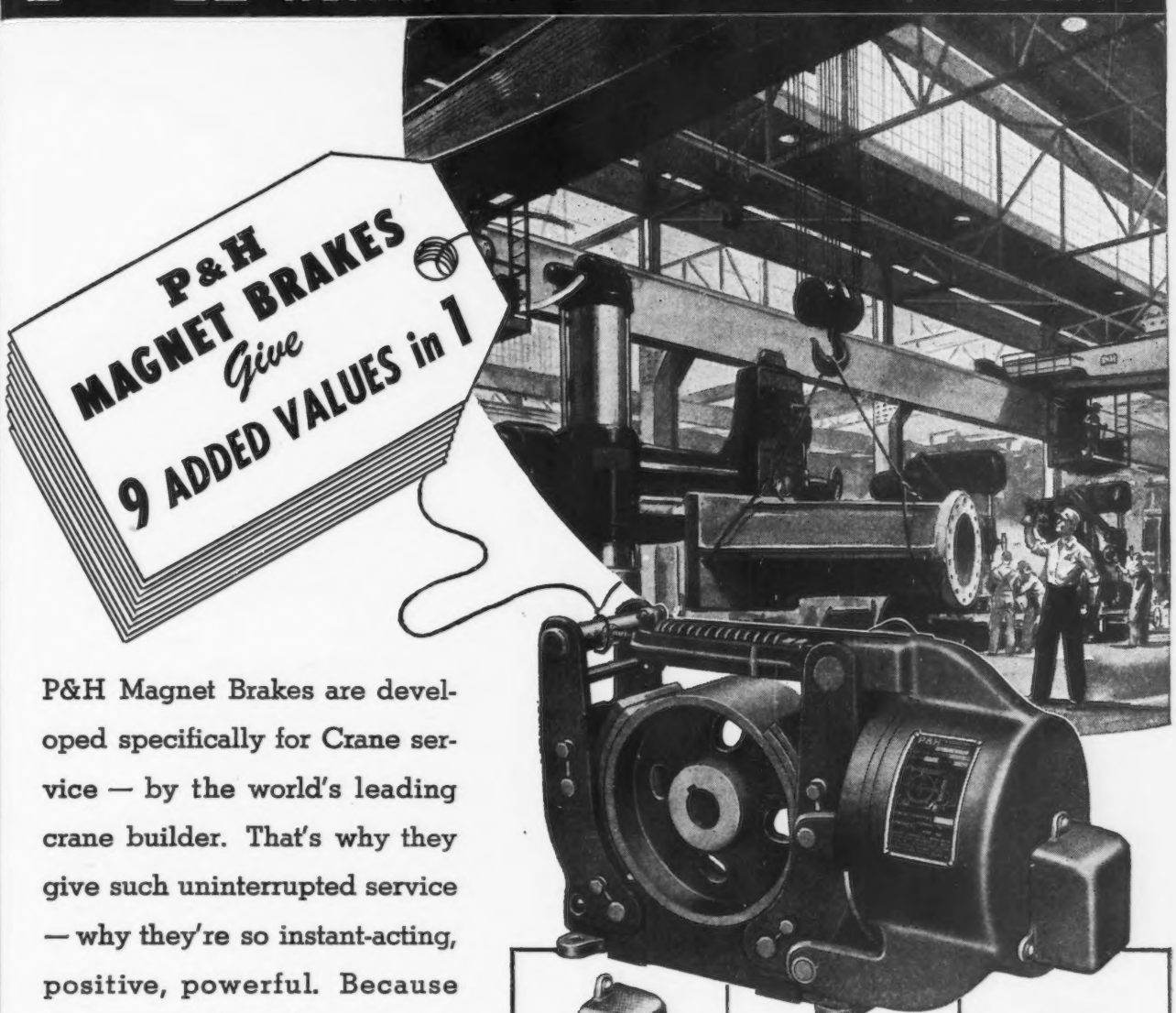
	FINISHED STEEL HIGH	FINISHED STEEL LOW	PIG IRON HIGH	PIG IRON LOW	SCRAP STEEL HIGH	SCRAP STEEL LOW
1946	2.73011¢ July 4	2.54490¢ Jan. 1	$28.13 May 29	$25.37 Jan. 1	$24.75 Nov. 19	$19.17
1945	2.44104¢ Oct. 2	2.38444¢ Jan. 2	25.37 Oct. 23	23.61 Jan. 2	$19.17 Jan. 2	$18.92 May 22
1944	2.30837¢ Sept. 5	2.21189¢ Oct. 5	$23.61	$23.61	19.17 Jan. 11	15.76 Oct. 24
1943	2.29176¢	2.29176¢	23.61	23.61	$19.17	$19.17
1942	2.28249¢	2.28249¢	23.61	23.61	19.17	19.17
1941	2.43078¢	2.43078¢	$23.61 Mar. 20	$23.45 Jan. 2	$22.00 Jan. 7	$19.17 Apr. 10
1940	2.30467¢ Jan. 2	2.24107¢ Apr. 16	23.45 Dec. 23	22.61 Jan. 2	21.83 Dec. 30	16.04 Apr. 9
1939	2.35367¢ Jan. 3	2.26689¢ May 16	22.61 Sept. 19	20.61 Sept. 12	22.50 Oct. 3	14.08 May 16
1938	2.58414¢ Jan. 4	2.27207¢ Oct. 18	23.25 June 21	19.61 July 6	15.00 Nov. 22	11.00 June 7
1937	2.58414¢ Mar. 9	2.32263¢ Jan. 4	23.25 Mar. 9	20.25 Feb. 16	21.92 Mar. 30	12.67 June 9
1936	2,32263¢ Dec. 28	2.05200¢ Mar. 10	19.74 Nov. 24	18.73 Aug. 11	17.75 Dec. 21	12.67 June 8
1935	2.07642¢ Oct. 1	2.06492¢ Jan. 8	18.84 Nov. 5	17.83 May 14	13.42 Dec. 10	10.33 Apr. 29
1934	2.15367¢ Apr. 24	1.95757¢ Jan. 2	17.90 May 1	16.90 Jan. 27	13.00 Mar. 13	9.50 Sept. 25
1933	1.95578¢ Oct. 3	1.75836¢ May 2	16.90 Dec. 5	13.56 Jan. 3	12.25 Aug. 8	6.75 Jan. 3
1932	1.89196¢ July 5	1.83901¢ Mar. 1	14.81 Jan. 5	13.56 Dec. 6	8.50 Jan. 12	6.43 July 5
1931	1.99626¢ Jan. 13	1.86586¢ Dec. 29	15.90 Jan. 6	14.79 Dec. 15	11.33 Jan. 6	8.50 Dec. 29
1930	2.25488¢ Jan. 7	1.97319¢ Dec. 9	18.21 Jan. 7	15.90 Dec. 16	15.00 Feb. 18	11.25 Dec. 9
1929	2.31773¢ May 28	2.26498¢ Oct. 29	18.71 May 14	18.21 Dec. 17	17.58 Jan. 29	14.08 Dec. 3

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 pct of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia, and Chicago.

P&H ELECTRICAL EQUIPMENT . . . HEART OF CRANE DEPENDABILITY



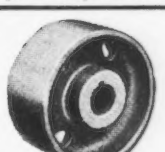
P&H Magnet Brakes are developed specifically for Crane service — by the world's leading crane builder. That's why they give such uninterrupted service — why they're so instant-acting, positive, powerful. Because P&H builds the *whole* crane — electrical equipment and motors included — every crane-engineered detail is an Added Value!

Safety cover *protects* terminals.

Simple, accessible one-*point* adjustment.

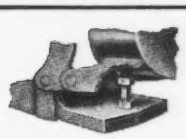
Highest grade *molded* brake linings.

Safety locking arrangement holds all pins *stationary*.



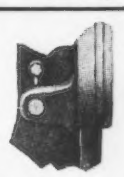
Balanced brake wheel of special *nickel chrome alloy* semi-steel.

No cotter pins to catch on clothing.



Jaw stop insures *equal* opening of both jaws — linings wear evenly and longer.

Designed for floor or motor mounting.



Short, 3/64-inch magnet stroke.

FREE ENTERPRISE MEANS:
Better products—for more people—at lower cost

P&H

ELECTRIC OVERHEAD CRANES
4401 W. National Avenue
Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION
ELECTRIC CRANES · EXCAVATORS · ARC WELDERS · P&H · HOISTS · WELDING ELECTRODES · MOTORS

Iron and Steel Prices . . .

Steel prices shown here are f.o.b. basing points, in cents per pound or dollars per gross ton. Extras apply. Delivered prices do not reflect 3 pct tax on freight. (1) Mill run sheet, 10¢ per 100 lb under base; primes, 25¢ above base. (2) Unassorted commercial coating. (3) Widths up to 12-in. inclusive. (4) 0.25 carbon and less. (5) Applies to certain width and length limitations. (6) For merchant trade. (7) For straight length material only from producer to consumer. Discount of 25¢ per 100 lb to fabricators. (8) Also shafting. For quantities of 20,000 lb to 39,999 lb. (9) Carload lot in manufacturing trade. (10) Prices do not apply if rail and water is not used. (11) Boxed. (12) This base price for annealed, bright finish wires, commercial spring wire. (13) Produced to dimensional tolerances in AISI Manual Sect. 6. (14) Billets only. (15) 9/32 in. to 47/64 in., 0.15¢ per lb higher.

Basing Points	Pitts-burgh	Chicago	Gary	Cleve-land	Birm-ingham	Buffalo	Youngs-town	Spar-rows Point	Granite City	Middle-town, Ohio	Gulf Ports, Cars	10 Pacific Ports, Cars	DELIVERED TO Detroit	New York	Phila-delphia
INGOTS Carbon, rerolling	($33.00 f. o. b. mill)														
Carbon, forging	$38	$38	$38	$38	$38	$38	$38								
Alloy	$48.69	$48.69				$48.69	(Bethlehem, Massillon, Canton, Coatesville=$48.69)								
BILLETS, BLOOMS, SLABS Carbon, rerolling	$39	$39	$39	$39	$39	(Provo=$50.20, Duluth=$41[14]) $39	$39	$39				$51.50[14]	$41.50		
Carbon, forging billets	$47	$47	$47	$47	$47	(Provo=$58.20, Duluth=$49[14]) $47	$47					$59.50[14]	$49.50		
Alloy	$58.43	$58.43				$58.43	(Bethlehem, Massillon, Canton=$58.43)						$60.93		
SHEET BARS	$38	$38		$38		$38	$38	$38	(Canton=$38)						
PIPE SKELP	2.05¢	2.05¢					2.05¢	2.05¢	(Coatesville=2.05¢)						
WIRE RODS [15] No. 5 to 9/32 in.	2.30¢	2.30¢		2.30¢	2.30¢	(Worcester=2.40¢)					2.585¢	2.835¢			
SHEETS															
Hot-rolled	2.425¢	2.425¢	2.425¢	2.425¢	2.425¢	2.425¢	2.425¢	2.425¢	2.875¢	2.425¢		3.01¢	2.56¢	2.685¢	2.615¢
Cold-rolled [1]	3.275¢	3.275¢	3.275¢	3.275¢		3.275¢	3.275¢		3.375¢	3.275¢		3.96¢	3.41¢	3.635¢	3.635¢
Galvanized (24 gage)	4.05¢	4.05¢	4.05¢		4.05¢	4.05¢	4.05¢	4.05¢	4.50¢	4.05¢		4.635¢		4.31¢	4.24¢
Enameling (20 gage)	3.80¢	3.80¢	3.80¢	3.80¢			3.80¢		3.90¢	3.80¢		4.485¢	3.935¢	4.20¢	4.16¢
Enameling (10 Gage)	3.20¢	3.20¢	3.20¢	3.20¢			3.20¢		3.30¢	3.20¢		3.885¢	3.335¢	3.60¢	3.56¢
Long ternes [2]	4.05¢	4.05¢	4.05¢									4.835¢		4.45¢	4.41¢
STRIP Hot-rolled [3] 6 in. and under	2.45¢	2.45¢	2.45¢	2.45¢	2.45¢		2.45¢			2.45¢		3.135¢	2.585¢	2.85¢	2.81¢
Hot-rolled [3] over 6 in.	2.35¢	2.35¢	2.35¢	2.35¢	2.35¢		2.35¢			2.35¢		3.035¢	2.485¢	2.75¢	2.71¢
Cold-rolled [4]	3.05¢	3.15¢		3.05¢			3.05¢	(Worcester=3.25¢)					3.185¢	3.45¢	3.41¢
Cooperage stock	2.55¢	2.55¢			2.55¢		2.55¢							2.95¢	
TINPLATE Standard cokes, base box	$5.00	$5.00	$5.00		$5.10			$5.10	$5.10					$5.375	$5.301
Electro, box 0.25 lb	Deduct 65¢ from standard coke base box price.														
Electro, box 0.50 lb	Deduct 50¢ from standard coke base box price.														
Electro, box 0.75 lb	Deduct 35¢ from standard coke base box price.														
BLACKPLATE 29 gage [5]	3.30¢	3.30¢	3.30¢					3.40¢	3.40¢					3.67¢	3.59¢
TERNES, MFG. Special coated, base box	Deduct 70¢ from standard coke base box price.														
CAN MAKING QUALITY Blackplate 55 to 70 lb	Deduct $1.30 from standard coke base box price.														
BARS Carbon steel	2.50¢	2.50¢	2.50¢	2.50¢	2.50¢	2.50¢	2.50¢	(Duluth=2.60¢) (Provo, Utah=3.20¢)			2.885¢	3.185¢	2.635¢	2.84¢	2.86¢
Rail steel [6]	2.50¢	2.50¢	2.50¢	2.50¢	2.50¢	2.50¢					2.885¢	3.185¢			
Reinforcing (billet) [7]	2.35¢	2.35¢	2.35¢	2.35¢	2.35¢	2.35¢	2.35¢	2.35¢			2.735¢	2.785¢	2.485¢	2.61¢	2.69¢
Reinforcing (rail) [7]	2.35¢	2.35¢	2.35¢	2.35¢	2.35¢	2.35¢	2.35¢				2.735¢	2.785¢	2.485¢		
Cold-finished [8]	3.10¢	3.10¢	3.10¢	3.10¢		3.10¢	(Detroit=3.15¢) (Toledo=3.25¢)							3.44¢	3.46¢
Alloy, hot-rolled	2.92¢	2.92¢				2.92¢	2.92¢	(Bethlehem, Massillon, Canton=2.92¢)					3.055¢		
Alloy, cold-drawn	3.62¢	3.62¢	3.62¢	3.62¢		3.62¢							3.765¢		
PLATE Carbon steel [13]	2.50¢	2.50¢	2.50¢	2.50¢	2.50¢		2.50¢	(Coatesville, Claymont=2.50¢ Geneva, Utah=2.65¢) 2.50¢			2.885¢	3.085¢	2.755¢	2.71¢	2.558¢
Floor plates	3.75¢	3.75¢									4.135¢	4.435¢		4.15¢	4.15¢
Alloy	3.79¢	3.79¢			(Coatesville=3.79¢)						4.305¢	4.525¢		4.01¢	3.895¢
SHAPES Structural	2.35¢	2.35¢	2.35¢		2.35¢	2.35¢	(Geneva, Utah=2.50¢) (Bethlehem=2.35¢)				2.735¢	3.035¢		2.54¢	2.48¢
SPRING STEEL, C-R 0.26 to 0.50 carbon	3.05¢			3.05¢			(Worcester=3.25¢)								
0.51 to 0.75 carbon	4.65¢			4.65¢			(Worcester=4.85¢)								
0.76 to 1.00 carbon	6.65¢			6.65¢			(Worcester=6.85¢)								
1.01 to 1.25 carbon	9.03¢			9.03¢			(Worcester=9.23¢)								
WIRE [9] Bright [12]	3.05¢	3.05¢		3.05¢	3.05¢		(Worcester=3.15¢) (Duluth=3.10¢)					3.585¢		3.44¢	3.41¢
Galvanized	Add proper size extra and galvanizing extra to Bright Wire Base														
Spring (high carbon)	4.00¢	4.00¢		4.00¢			(Worcester=4.10¢)			(Trenton=4.25¢)		4.535¢		4.39¢	4.339¢
PILING Steel sheet	2.65¢	2.65¢				2.65¢						3.235¢		2.99¢	3.01¢

CORROSION AND HEAT RESISTANT STEELS

In cents per pound, f.o.b. basing point

BASING POINT	Chromium Nickel		Straight Chromium			
	No. 304	No. 302	No. 410	No. 430	No. 442	No. 446
Ingot, P'gh, Chi, Canton, Balt, Reading, Ft. Wayne, Phila.	Subject to negotiation			Subject to negotiation		
Blooms, P'gh, Chi, Canton, Phila, Reading, Ft. Wayne, Balt.	22.99	24.67	17.01	17.47	20.69	25.29
Slabs, P'gh, Chi, Canton, Balt, Phila, Reading	22.99	24.67	17.01	17.47	20.69	25.29
Billets P'gh, Chi, Canton, Watervliet, Syracuse, Balt.	Subject to negotiation			Subject to negotiation		
Billets, forging, P'gh, Chi, Canton Dunkirk, Balt, Phila, Reading, Watervliet, Syracuse, Ft. Wayne, Titusville	22.99	24.67	17.01	17.47	20.69	25.29
Bars, h-r, P'gh, Chi, Canton, Dunkirk, Watervliet, Syracuse, Balt, Phila, Reading, Ft. Wayne, Titusville	27.05	25.97	20.02	20.56	24.34	29.75
Bars, c-f, P'gh, Chi, Cleve, Canton, Dunkirk, Syracuse, Balt, Phila, Reading, Ft. Wayne, Watervliet	27.05	25.97	20.02	20.56	24.34	29.75
Plates, P'gh, Middletown, Canton	31.38	29.21	23.28	23.80	28.67	33.00
Shapes, structural, P'gh, Chi	27.05	25.97	20.02	20.56	24.34	29.75
Sheets, P'gh, Chi, Middletown, Canton, Balt.	38.95	38.79	28.67	31.38	35.16	38.49
Strip, h-r, P'gh, Chi, Reading, Canton, Youngstown	25.43	23.28	18.39	18.93	25.97	37.87
Strip, c-r, P'gh, Cleve, Newark, N. J., Reading, Canton, Youngstown	32.46	30.30	23.80	24.34	34.62	56.28
Wire, c-d, Cleve, Dunkirk, Syracuse, Balt, Reading, Canton, P'gh, Newark, N. J., Phila.	27.05	25.97	20.02	20.56	24.34	29.75
Wire, flat, c-r, Cleve, Balt, Reading, Dunkirk, Canton	32.46	30.30	23.80	24.34	34.62	56.28
Rod, h-r, Syracuse	27.05	25.97	20.02	20.56	24.34	29.75
Tubing, seamless, P'gh, Chi, Canton, (4 in. to 8 in.)	72.09	72.09	.....	68.49	.....	.....

TOOL STEEL

*(F.o.b. Pittsburgh, Bethlehem, Syracuse, Dunkirk. *Also Canton, O.)*

An increase of 8.2 pct applies to base price and extras

	Base per lb
High speed	67¢
Straight molybdenum	54¢
Tungsten-molybdenum	57½¢
High-carbon-chromium*	43¢
Oil hardening*	24¢
Special carbon*	22¢
Extra carbon*	18¢
Regular carbon*	14¢

Warehouse prices on and east of Mississippi are 2¢ per lb higher; west of Mississippi 3¢ higher.

ELECTRICAL SHEETS

Base, all grades f.o.b. Pittsburgh

	per lb
Field grade	3.90¢
Armature	4.25¢
Electrical	4.75¢
Motor	5.425¢
Dynamo	6.125¢
Transformer 72	6.625¢
Transformer 65	7.625¢
Transformer 58	8.125¢
Transformer 52	8.925¢

F.o.b. Chicago and Gary, field grade through motor; f.o.b. Granite City, add 10¢ per 100 lb on field grade to and including dynamo. Pacific ports add 75¢ per 100 lb on all grades.

RAILS, TRACK SUPPLIES

(F.o.b. mill)

Standard rails, heavier than 60 lb No. 1 O.H., net ton	$43.39
Angle splice bars, 100 lb	2.85
(F.o.b. basing points)	*per net ton*
Light rails (from billets)	$49.18
Light rails (from rail steel)	49.18
	base per lb
Cut spikes	3.65¢
Screw spikes	*5.15¢
Tie plate, steel	2.55¢
Tie plates, Pacific Coast	2.70¢
Track bolts	6.50¢
Track bolts, heat treated, to railroads	6.75¢
Track bolts, jobbers discount	63-5

*Plus 12 pct.

Basing points, light rails, Pittsburgh, Chicago, Birmingham; cut spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo. Cut spikes alone—Youngstown, Lebanon, Pa., Richmond, Oregon and Washington ports, add 25¢.

ROOFING TERNEPLATE

(F.o.b. Pittsburgh, 112 sheets)

	20x14 in.	20x28 in.
8-lb coating I.C.	$8.50	$17.00
15-lb coating I.C.	9.50	19.00
20-lb coating I.C.	10.00	20.00

CLAD STEEL

Base prices, cents per pound

	Plate	Sheet
Stainless-clad		
No. 304, 20 pct, f.o.b. Pittsburgh, Washington, Pa.	21.00*	22.00
Nickel-clad		
10 pct, f.o.b. Coatesville, Pa.	18.72	....
Inconel-clad		
10 pct, f.o.b. Coatesville	26.00	....
Monel-clad		
10 pct, f.o.b. Coatesville	24.96	....
Aluminized steel		
Hot dip, 20 gage, f.o.b. Pittsburgh	....	9.00

*Includes annealing and pickling.

WIRE PRODUCTS

To the dealer, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham, Duluth

	Basing Points Named	Pacific Coast Basing Points†
	base per keg	
Standard wire nails	$3.75	$4.25
Coated nails	3.75	4.25
Cut nails, carloads	4.85	....
	base per 100 lb	
Annealed fence wire	$3.50	$4.00
Annealed galv. fence wire	3.85	4.35
	base column	
Woven wire fence*	72	90
Fence posts, carloads	74	91
Single loop bale ties††	72	97
Galvanized barbed wire**	79	89
Twisted barbless wire	79	89

*15½ gage and heavier. **On 80-rod spools in carload quantities.

†Prices subject to switching or transportation charges.

††Add 50c a ton.

HIGH TENSILE, LOW ALLOY STEELS

base prices, cents per pound

Steel	Aldecor	Corten	Double Strength No. 1	Dynalloy	Hi Steel	Mayari R	Otis-coloy	Yoloy	Y-50
Producer	Republic	Carnegie-Illinois, Republic	Republic	Alan Wood	Inland	Bethlehem	Jones & Laughlin	Youngstown Sheet & Tube	American Rolling Mill
Plates	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	.....
Sheets									
Hot-rolled	3.575	3.575	3.575	3.575	3.575	3.575	3.575	3.575	.....
Cold-rolled	4.525	4.525	4.525	.....	4.525	4.525	4.525	4.525	5.225*
Galvanized	.....	.....	.....	.....	.....	5.50	.....	.....	.....
Strip									
Hot-rolled									
Over 6-in.	3.60	3.60	3.60	.....	3.60	3.60	3.60	3.60	.....
6-in & under	3.70	3.70	3.70	.....	3.70	3.70	3.70	3.70	.....
Cold-rolled	4.30	.....	4.30	.....	4.40	.....	4.30	4.30	5.00*
Commodity	.....	.....	.....	.....	.....	.....	4.45	.....	.....
Shapes	.....	3.45	.....	.....	3.45	3.45	3.45	3.45	.....
Beams	.....	3.45	.....	.....	.....	3.45	.....	.....	.....
Bars									
Hot-rolled	3.70	3.70	3.70	.....	.....	3.70	3.70	3.732†‡	.....
Cold rolled	.....	.....	.....	.....	.....	.....	.....	4.382†‡	.....
Bar shapes	.....	3.85	.....	.....	3.85	3.85	3.85	3.85	.....
Billets, blooms, slabs (per gross ton)									
Structural	.....	.....	.....	.....	.....	.....	.....	$74.65†	.....
Forging	.....	.....	.....	.....	.....	.....	.....	$82.23†	.....

* 21 gage and lighter. † Alloy extras apply. ‡ Add 0.379¢ for forging or heat treating grade.

WELDED PIPE AND TUBING

Base discounts, f.o.b. Pittsburgh district and Lorain, Ohio, mills

(F.o.b. Pittsburgh only on wrought pipe)
Base price—$200.00 per net ton

Steel (buttweld)

	Black	Galv.
⅛-in.	60½	48
¼-in.	63½	52
⅜-in. to 3-in.	65½	54½

Wrought Iron (buttweld)

⅛-in.	17⅞	+4⅝
¼-in.	24¼	2⅝
⅜-in. and 1¼-in.	28⅝	9⅛
1½-in.	33	11⅞
2-in.	32⅝	11⅝

Steel (lapweld)

2-in.	58	46½
2½-in. and 3-in.	61	49½
3½-in. to 6-in.	63	51½

Wrought Iron (lapweld)

2-in.	24⅞	4⅞
2½-in. to 3½-in.	25⅞	7⅞
4-in.	28⅛	11⅝
4½-in. to 8-in.	27	10¼

Steel (butt, extra strong, plain ends)

⅛-in.	58½	47½
¼-in.	62½	51½
⅜-in. to 3-in.	64	54

Wrought Iron (same as above)

⅛-in.	18⅞	+1⅝
¼-in.	25⅝	4¾
⅜-in. to 2-in.	33	13

Steel (lap, extra strong, plain ends)

2-in.	56	45½
2½-in. and 3-in.	60	49½
3½-in. to 6-in.	63½	53

Wrought Iron (same as above)

2-in.	28⅛	8⅝
2½-in. to 4-in.	34	16¼
4½-in. to 6-in.	32⅝	14⅝

On buttweld and lapweld steel pipe jobbers are granted a discount of 5 pct. On l.c.l. shipments prices are determined by adding 25 pct and 30 pct and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lapweld and one point lower discount, or $2 a ton higher on all buttweld.

BOILER TUBES

Seamless steel and lapweld commercial boiler tubes and locomotive tubes, minimum wall. Net base prices per 100 ft f.o.b. Pittsburgh, in carload lots

	Seamless Cold-Drawn	Seamless Hot-Rolled	Lapweld, Hot-Rolled
2 in. O.D. 13 B.W.G.	16.52	13.90	13.20
2½ in. O.D. 12 B.W.G.	22.21	18.70	17.67
3 in. O.D. 12 B.W.G.	24.71	20.79	19.56
3½ in. O.D. 11 B.W.G.	31.18	26.25	24.68
4 in. O.D. 10 B.W.G.	38.68	32.56	30.55

(Extras for less carload quantities)

40,000 lb or ft and over	Base
30,000 lb or ft to 39,999 lb or ft	5 pct
20,000 lb or ft to 29,999 lb or ft	10 pct
10,000 lb or ft to 19,999 lb or ft	20 pct
5,000 lb or ft to 9,999 lb or ft	30 pct
2,000 lb or ft to 4,999 lb or ft	45 pct
Under 2,000 lb or ft	65 pct

CAST IRON WATER PIPE

	Per net ton
6-in. to 24-in., del'd Chicago	$70.33
6-in. to 24-in., del'd New York	69.60
6-in. to 24-in., Birmingham	61.00
6-in. and larger, f.o.b. cars, San Francisco, Los Angeles or Seattle for all rail shipment; rail and water shipment less	84.40

Class "A" and gas pipe, $5 extra; 4-in. pipe is $5 a ton above 6-in.

BOLTS, NUTS, RIVETS, SET SCREWS

An increase of 12 pct applies to listings except Large Rivets

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts

Base discount less case lots

	Percent Off List
½ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1¼ in. and larger, all lengths	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed

(Hexagon or Square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 pct for full container quantities. There is an additional 5 pct allowance for carload shipments.

Semifin. Hexagon Nuts	U.S.S.	S.A.E.
Base discount less keg lots		
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 in. through 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full keg lots, 10 pct additional discount. For 200 lb or more, freight allowed up to 50¢ per 100 lb, based on Cleveland, Chicago, Pittsburgh.

Stove Bolts

	Consumer
Packages, nuts loose	71 and 10
In packages	71
In bulk	80

On stove bolts freight allowed up to 65¢ per 100 lb based on Cleveland, Chicago, New York on lots of 200 lb or over.

Large Rivets
(½ in. and larger)

	Base per 100 Lb
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$4.75
F.o.b. Lebanon, Pa.	4.90

Small Rivets
(7/16 in. and smaller)

	Percent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 5

Cap and Set Screws *(In packages)*	*Percent Off List* Consumer
Upset full fin, hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Fillister head cap, listed sizes	51

Freight allowed up to 65¢ per 100 lb based on Cleveland, Chicago or New York on lots of 200 lb or over.

FLUORSPAR

Maximum price f.o.b. consumer's plant, $30 per short ton plus either (1) rail freight from producer to consumer, or (2) rail freight from Rosiclare, Ill., to consumer, whichever is lower.

Effective CaF_2 Content:	Base price per short ton
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

LAKE SUPERIOR ORES

(51.50% Fe, Natural Content, Delivered Lower Lake Ports)

	Per Gross Ton
Old range, bessemer	$5.45
Old range, non-bessemer	5.30
Mesaba, bessemer	5.20
Mesaba, non-bessemer	5.05
High phosphorus	5.05

Prices are for ore shipped on and after June 24, 1946, and for ore covered by adjustable pricing agreements authorized by Order No. 8, RMPR 113.

These prices do not reflect the recent ICC increase in freight rates.

METAL POWDERS

Prices in cents per pound in ton lots, f.o.b. shipping point.

Brass, minus 100 mesh	19¼¢ to 21½¢
Copper, electrolytic, 100 and 375 mesh	23½¢ to 27½¢
Copper, reduced, 150 and 200 mesh	23¾¢
Iron, commercial, 100, 200, 325, mesh 96 + % Fe	11¢ to 16¢
Swedish sponge iron, 100 mesh, c.l.f. N. Y., carlots, ocean bags	7.4¢ to 8¢
Iron, crushed, 200 mesh and finer, 90 + % Fe carload lots	4¢
Iron, hydrogen reduced, 300 mesh and finer, 98 + % Fe, drum lots	63¢
Iron, electrolytic, unannealed, 325 mesh and coarser, 99 + % Fe	25¢ to 31¢
Iron, electrolytic, annealed minus 100 mesh, 99 + % Fe	17¢
Iron carbonyl, 300 mesh and finer, 98-99.8 + % Fe	90¢ to $1.75
Aluminum, 100, 200 mesh, carlots	35¢
Antimony, 100 mesh	30¢
Cadmium, 100 mesh	$1.75
Chromium, 100 mesh and finer	$1.38
Lead, 100, 200 & 300 mesh	13¼¢ to 16¾¢
Manganese, minus 325 mesh and coarser	44¢ to 61¢
Nickel, 150 mesh	51½¢
Silicon, minus 325 mesh and coarser	26¢ to 55¢
Solder powder, 100 mesh	8½¢ plus metal
Tin, 100 mesh	58¾¢
Tungsten metal powder, 98%-99% any quantity, per lb	$2.60
Molybdenum powder, 99%, in 100-lb kegs, f.o.b. York, Pa., per lb	$2.65
Under 100 lb	$2.90

COKE

	Net Ton
Furnace, beehive (f.o.b. oven)	
Connellsville, Pa.	$8.75
Connellsville, Pa., hand drawn	9.35
Foundry, beehive (f.o.b. oven)	
Connellsville, Pa.	8.50
Foundry, Byproduct	
Chicago, del'd	15.10
Chicago, f.o.b.	14.35
New England, del'd	16.04
Kearny, N. J., f.o.b.	14.40
Philadelphia, del'd	14.63
Buffalo, del'd	14.75
Portsmouth, Ohio, f.o.b.	12.85
Painesville, Ohio, f.o.b.	13.50
Erie, del'd	14.50
Cleveland, del'd	14.55
Cincinnati, del'd	14.60
St. Louis, del'd	15.10†
Birmingham, del'd	12.25

†Except producers situated in states other than Missouri, Alabama or Tennessee, sellers may charge a maximum delivered price of $15.60 in the St. Louis Mo., and East St. Louis, Ill., switching districts.

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick

	Carloads Per 1000
Super-duty brick, St. Louis	$81.00
First quality, Pa., Md., Ky., Mo., Ill., Ohio	65.00
First quality, New Jersey	70.00
Sec. quality, Pa., Md., Ky., Mo., Ill.	59.00
Sec. quality, New Jesey	62.00
Sec. quality, Ohio	57.00
Ground fire clay, net ton, bulk	9.50

Silica Brick

Pennsylvania and Birmingham	$65.00
Chicago District	74.00
Silica cement, net ton (Eastern)	11.50
Chicago	12.50

Chrome Brick	Per Net Ton
Standard chemically bonded, Balt., Plymouth Meeting, Chester	$54.00

Magnesite Brick

Standard, Balt. and Chester	$76.00
Chemically bonded, Baltimore	65.00

Grain Magnesite

Domestic, f.o.b. Balt. and Chester in sacks	$44.50
Domestic, f.o.b. Chewelah, Wash., in bulk	22.00
in sacks	26.00
Clinker (dead burned) dolomite, bulk, per net ton, f.o.b. York, Pa.	10.05

Midwest, add 10¢; Mo. Valley, add 20¢

WAREHOUSE PRICES

Delivered metropolitan areas, per 100 lb.

Cities	SHEETS			STRIP			Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
				Hot-Rolled										
	Hot-Rolled (10 gage)	Cold-Rolled	Galvanized (24 gage)	6 in. and Under	Over 6 in.	Cold-Rolled			Hot-Rolled	Cold-Finished	Hot-Rolled, A-8617-20	Hot-Rolled, A-8742-50 Ann.	Cold-Drawn, A-8617-20	Cold-Drawn, A-8742-50 Ann.
**Philadelphia	$3.774	$5.139	$5.249*	$4.314	$4.214	$5.064	$3.875	$3.937	$4.114	$4.564	$6.287	$7.387	$7.664	$8.764
New York	3.856	4.869	5.501	4.375	4.275	5.075	4.049	4.038	4.134	4.584	6.338	7.438	7.684	8.784
Boston	4.05	5.031	5.725	4.518	4.418	4.985	4.203	4.023	4.356	4.656	6.503	7.603	7.756	8.858
Baltimore	3.64	5.118	5.365	4.293	4.193	....	3.865	4.05	4.093	4.543	....	....	....	....
Norfolk	4.037		5.862	4.577	4.477	....	4.262	4.303	4.377	4.677	....	....	....	....
Chicago	3.475	4.425	5.40	3.95	3.85	4.90[6]	3.80	....	3.75	4.20	6.05	7.15	7.20	8.30
Milwaukee	3.633	4.583	5.558	4.108	4.008	5.058[6]	3.958	3.958	3.908	4.358	6.308	7.408	7.458	8.558
Cleveland	3.575	....	5.347	3.95	3.85	....	3.65	3.88	3.60	4.20	6.277	7.377	7.20	8.30
Buffalo	3.575	4.625	5.20	4.211	4.111	4.961	3.921	3.65	3.60	4.20	6.05	7.15	7.20	8.30
Detroit	3.71	4.76	5.528	4.085	3.985	4.95	3.935	3.987	3.735	4.285	6.456	7.556	7.585	8.685
Cincinnati	3.671	4.721	5.296	4.046	3.946	5.002	3.952	3.983	3.902	4.502	6.441	7.541	7.602	8.702
St. Louis	3.643	4.593	5.622	4.118	4.018	5.222	3.968	3.968	3.918	4.522	6.472	7.572	7.622	8.722
Pittsburgh	3.575	4.625	5.20	3.95	3.85	4.70	3.65	3.65	3.60	4.20	6.05	7.15	7.20	8.30
St. Paul	3.817	4.767	5.666	4.292	4.192	5.000	4.142	4.142	4.092	4.852	....	8.322	7.952	8.052
Duluth	3.817	4.767	5.666	4.292	4.192	....	4.142	4.142	4.092		6.472	8.572	....	....
Omaha	4.045	5.72	6.00	4.52	4.42	....	4.37	4.37	4.32	4.945	....	....	....	....
Indianapolis	3.775	4.825	5.40	4.15	4.05	5.03	3.92	3.92	3.87	4.47	6.17	....	7.32	....
Birmingham	3.675	....	5.20	4.05	3.95	....	3.80	3.80	3.75	4.954	6.414	7.514	7.564	8.614
Memphis	4.221	....	5.748	4.596	4.496	....	4.346	4.346	4.296	4.821	....	....	....	....
New Orleans	4.359*	5.40[1]	5.884	4.734	4.634	....	4.484	4.484*	4.434*	5.175	....	....	....	....
Los Angeles	4.885	6.635[1]	6.585	5.335	5.235	....	4.835	4.735	4.685	6.065	....	....	....	....
San Francisco	4.435	6.035	6.585	4.885	4.785	....	4.535	4.385	4.435	5.815	....	....	....	....
Seattle	4.905[5]	7.305[2]	6.435	4.635	4.535	....	5.035[5]	4.735[5]	4.635[5]	6.265	7.735[8]	8.735[8]	....	9.585[8]
Portland	4.905[4]	....	6.235	5.135	....	....	5.035[4]	4.735[4]	4.735[4]	6.015	7.735	8.885	....	....
Salt Lake City	4.81	....	6.70	5.94	5.84	....	5.29	5.29	5.19	6.49	....	....	....	....

BASE QUANTITIES

Standard unless otherwise keyed on prices.

HOT-ROLLED: Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD-ROLLED: Sheets, 400 to 1999 lb; strip, extras on all quantities; bars, 1500 lb base.

ALLOY BARS: 1000 to 39,999 lb.

GALVANIZED SHEETS: 450 to 1499 lb.

EXCEPTIONS: (1) 400 to 1499 lb; (2) 450 to 1499 lb; (3) 450 to 3749 lb; (4) 300 to 4999 lb; (5) 300 to 10,000 lb; (6) 2000 lb and over; (7) 3500 lb and over; (8) 1000 lb and over.

(a) Philadelphia: Galvanized sheet, 25 or more bundles.

Extra for size, quality, etc., apply on above quotations.

* Add 29.1¢ for sizes not rolled in Birmingham.

** City of Philadelphia only. Applicable freight rates must be added to basing point prices to obtain delivered price to other localities in metropolitan area.

PIG IRON PRICES

Per gross ton.

BASING POINT PRICES						DELIVERED PRICES (BASE GRADES)							
Basing Point	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.	Consuming Point	Basing Point	Freight Rate	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Bethlehem	29.00	29.50	30.00	30.50	....	Boston	Everett	$0.50 Arb.	29.50	30.00	30.50	31.00	....
Birdsboro	31.00	31.50	32.00	32.50	36.00	Boston	Birdsboro-Steelton	4.47	....	....	....	....	38.47†
Birmingham	23.50*	24.88*	....	29.50	....	Brooklyn	Bethlehem	2.78	31.78	32.28	32.78	33.28	....
Buffalo	27.50	28.50	29.00	29.50	34.00	Brooklyn	Birdsboro	3.26	....	....	....	....	37.26
Chicago	28.00	28.50	28.50	29.00	.....	Canton	Clev. Ygstn, Sharpsvil.	1.54	29.54	30.04	30.04	30.54	....
Cleveland	28.00	28.50	28.50	29.00	.....	Canton	Buffalo	3.55	....	....	....	....	37.58
Detroit	28.00	28.50	28.50	29.00	.....	Cincinnati	Birmingham	4.30	27.80*	29.18*	....	....	....
Duluth	28.50	29.00	29.00	29.50	.....	Cincinnati	Hamilton	1.24	....	....	29.74	....	....
Erie	28.00	28.50	29.00	29.50	.....	Cincinnati	Buffalo	4.89	....	....	....	....	38.89
Everett	29.00	29.50	30.00	30.50	.....	Jersey City	Bethlehem	1.70	30.70	31.20	31.70	32.20	....
Granite City	28.00	28.50	28.50	29.00	.....	Jersey City	Birdsboro	2.16	....	....	....	....	36.16
Hamilton	28.00	28.50	28.50	.....	.....	Los Angeles	Provo	5.25	31.25	31.75	.....	.....	....
Neville Island	28.00	28.50	28.50	29.00	.....	Los Angeles	Buffalo	16.33	....	....	....	*	50.33
Provo	26.00	26.50	.....	.....	.....	Mansfield	Cleveland-Toledo	2.16	30.16	30.66	30.66	31.16	....
Sharpsville	28.00	28.50	28.50	29.00	.....	Mansfield	Buffalo	3.74	....	....	....	....	37.74
Sparrows Point	29.00	29.50	.....	.....	.....	Philadelphia	Swedeland	0.93	29.93	30.43	30.93	31.43	....
Steelton	29.00	.....	.....	.....	34.00	Philadelphia	Birdsboro	1.38	....	....	.....	.....	35.38
Swedeland	29.00	29.50	30.00	30.50	.....	San Francisco	Provo	5.25	31.25	31.75	.....	.....	....
Toledo	28.00	28.50	28.50	29.00	.....	San Francisco	Buffalo	16.33	....	....	.....	.....	50.33
Youngstown[1]	28.00	28.50	28.50	29.00	.....	Seattle	Provo	5.25	31.25	31.75	.....	.....	....
						Seattle	Buffalo	16.33	....	....	.....	.....	50.33
						St. Louis	Granite City	0.50 Arb.	28.50	29.00	29.00	29.50	....
						St. Louis	Buffalo	7.86	.....	.....	.....	.....	41.86

* Republic Steel Corp. charges $2 more on basic and foundry pig iron produced at Birmingham.
† Pig iron produced at Birdsboro, Pa., add $2.00.

(1) Struthers Iron & Steel Co., Struthers, Ohio, charges 50¢ per ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

Charcoal pig iron base prices for Lyles, Tenn., and Lake Superior furnaces, $33.00 and $34.00, respectively. Newberry Brand of Lake Superior charcoal iron $39.00 per g.t., f.o.b. furnace. Delivered to Chicago, $42.34.

High phosphorus iron sells at Lyles, Tenn., at $28.50.

Basing point prices are subject to switching charges; silicon differentials (not to exceed 50¢ per ton for each 0.25 pct silicon content in excess of base grade which is 1.75 to 2.25 pct); phosphorus differentials, a reduction of 38¢ per ton for phosphorous content of 0.70 pct and over; manganese differentials, a charge not to exceed 50¢ per ton for each 0.50 pct manganese content in excess of 1.00 pct. $2 per ton extra may be charged for 0.5 to 0.75 pct nickel content and $1 per ton extra for each additional 0.25 pct nickel.

Silvery iron, silicon 6.00 to 6.50 pct, C/L per g.t., f.o.b. Jackson, Ohio—$48.00; f.o.b. Buffalo—$49.25. Add $1.00 per ton for each additional 0.50 pct Si. Add 50¢ per ton for each 0.50 pct Mn over 1.00 pct. Add $1.00 per ton for prices of comparable analysis.

Ferromanganese

78-82% Mn, maximum contract base price, gross ton, lump size, f.o.b. Baltimore, Philadelphia, New York, Birmingham, Rockdale, Rockwood, Tenn.

Carload lots (bulk)	$135.00
Less ton lots (packed)	148.50
F.o.b. Pittsburgh	139.50

$1.70 for each 1% above 82% Mn; penalty, $1.70 for each 1% below 78%.

Briquets—cents per pound of briquet, freight allowed, 66% contained Mn.

	Eastern	Central	Western
Carload, bulk	6.05	6.30	6.60
Ton lots	6.65	7.55	8.55
Less ton lots	6.80	7.80	8.80

Spiegeleisen

Contract prices, gross ton, lump, f.o.b. Palmerton, Pa.

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Carloads	$39.00	$40.00
F.o.b. Pittsburgh, Chicago	40.00	

Manganese Metal

Contract basis, lump size, cents per pound of metal, f.o.b. shipping point, freight allowed, eastern zone.

96% min. Mn, 0.2% max. C, 1% max. Si, 2% max. Fe.

Carload, bulk	30
L.c.l. lots	32

Electrolytic Manganese

F.o.b. Knoxville, Tenn., freight allowed east of Mississippi, cents per pound.

Carloads	32
Ton lots	34
Less ton lots	36

Low-Carbon Ferromanganese

Contract price, cents per pound Mn contained, lump size, f.o.b. shipping point, freight allowed, eastern zone.

	Carloads	Ton	Less
0.10% max. C, 0.06% P, 90% Mn	21.00	21.40	21.65
0.10% max. C	20.50	20.90	21.15
0.15% max. C	20.00	20.40	20.65
0.30% max. C	19.50	19.90	20.15
0.50% max. C	19.00	19.40	19.65
0.75% max. C, 7.00% max. Si	16.00	16.40	16.65

Silicomanganese

Contract basis, lump size, cents per pound of metal, f.o.b. shipping point, freight allowed. 65-70% Mn, 17-20% Si, 1.5% max. C.

Carload, bulk	6.05
Ton lots	6.70
Briquet, contract basis, carlots, bulk freight allowed, per lb of briquet.	5.80
Ton lots	6.30
Less ton lots	6.55

Silvery Iron (electric furnace)

Si 14.01 to 14.50%, $53.25 f.o.b. Keokuk, Iowa; $50.00 f.o.b. Jackson, Ohio; $51.25 f.o.b. Niagara Falls. Add $1.00 per ton for each additional 0.50% Si up to and including 18%. Add $1.00 per ton for low impurities, not to exceed: P—0.05%, S—0.04%, C—1.00%.

Silicon Metal

Contract price, cents per pound contained Si, lump size, f.o.b. shipping point, freight allowed, for ton lots, packed.

	Eastern	Central	Western
96% Si, 2% Fe	13.10	13.55	16.50
97% Si, 1% Fe	13.45	13.90	16.80

Ferrosilicon Briquets

Contract price, cents per pound of briquet, bulk, f.o.b. shipping point, freight allowed to destination, 40% Si.

	Eastern	Central	Western
Carload, bulk	3.60	3.75	3.90
Ton lots	4.15	4.55	4.60
Less ton lots	4.40	4.80	4.85

Electric Ferrosilicon

Contract price, cents per pound contained Si, lump size in carloads, f.o.b. shipping point, freight allowed.

	Eastern	Central	Western
50% Si	7.05	7.50	7.65
75% Si	8.55	8.70	9.25
80-90% Si	9.50	9.65	10.15
90-95% Si	11.80	11.95	12.40

Ferrochrome

(65-72% *Cr, 2% max. Si*)

Contract prices, cents per pound, contained Cr, lump size in carloads, f.o.b. shipping point, freight allowed.

	Eastern	Central	Western
0.06% C	23.00	23.40	24.00
0.10% C	22.50	22.90	23.50
0.15% C	22.00	22.40	23.00
0.20% C	21.50	21.90	22.50
0.50% C	21.00	21.40	22.00
1.00% C	20.50	20.90	21.50
2.00% C	19.50	19.90	20.50
66-71% Cr, 4-10% C	14.50	14.90	15.00
62-66% Cr, 5-7% C	15.05	15.45	15.55

Briquets—contract price, cents per pound of briquet, f.o.b. shipping point, freight allowed, 60% chromium.

	Eastern	Central	Western
Carload, bulk	9.20	9.50	9.90
Ton lots	9.80	10.30	11.80
Less ton lots	10.10	10.60	12.10

High-Nitrogen Ferrochrome

Low-carbon type: 67-72% Cr, 0.75% N. Add 2¢ per lb to regular low-carbon ferrochrome price schedule. Add 2¢ for each additional 0.25% N. High-carbon type: 66.71% Cr, 4-5% C, 0.75% N. Add 5¢ per lb to regular high-carbon ferrochrome price schedule.

S. M. Ferrochrome

Contract price, cents per pound chromium contained, lump size, f.o.b. shipping point, freight allowed.

High carbon type: 60-65% Cr, 4-6% Si, 4-6% Mn, 4-6% C.

	Eastern	Central	Western
Carload	15.60	16.00	16.10
Ton lots	16.65	17.30	18.50
Less ton lots	17.30	17.95	19.15

Low carbon type: 62-66% Cr, 4-6% Si, 4-6% Mn, 1.25% max. C.

	Eastern	Central	Western
Carload	20.00	20.40	21.00
Ton lots	21.00	21.65	22.85
Less ton lots	22.00	22.65	23.85

Chromium Metal

Contract prices, cents per lb, chromium contained, carload, f.o.b. shipping point, freight allowed. 97% min. Cr, 1% max. Fe.

	Eastern	Central	Western
0.20% max. C	83.50	85.00	86.25
0.50% max. C	79.50	81.00	82.25
9.00% min. C	79.50	81.00	82.25

Chromium—Copper

Contract price, cents per pound of alloy, f.o.b. Niagara Falls, freight allowed east of the Mississippi. 8-11% Cr, 88-90% Cu, 1.00% max. Fe, 0.50% max. Si.

Shot or ingot	45¢

Calcium—Silicon

Contract price per lb of alloy, lump, f.o.b. shipping point, freight allowed.

30-35% Ca, 60-65% Si, 3.00% max. Fe or 28-32% Ca, 60-65% Si, 6.00% max. Fe.

	Eastern	Central	Western
Carloads	13.00	13.50	15.55
Ton lots	14.50	15.25	17.40
Less ton lots	15.50	16.25	18.40

Calcium—Manganese—Silicon

Contract prices, cents per lb of alloy, lump, f.o.b. shipping point, freight allowed.

16-20% Ca, 14-18% Mn, 53-59% Si.

	Eastern	Central	Western
Carloads	15.50	16.00	18.05
Ton lots	16.50	17.35	19.10
Less ton lots	17.00	17.85	19.60

Calcium Metal

Eastern zone contract prices, cents per pound of metal, f.o.b. shipping point, freight allowed. Add 1¢ for central zone; 5¢ for western zone.

	Cast	Turnings	Distilled
Ton lots	$1.35	$1.75	$4.25
Less ton lots	1.60	2.00	5.00

CMSZ

Contract price, cents per pound of alloy, f.o.b. shipping point, freight allowed.

Alloy 4: 45-49% Cr, 4-6% Mn, 18-21% Si, 1.25-1.75% Zr, 3.00-4.5% C.

	Eastern	Central	Western
Ton lots	12.00	12.75	14.75
Less ton lots	12.50	13.25	15.25

Alloy 5: 50-56% Cr, 4-6% Mn, 13.50-16.00% Si, 0.75 to 1.25% Zr, 3.50-5.00% C.

	Eastern	Central	Western
Ton lots	11.75	12.50	14.50
Less ton lots	12.25	13.00	15.00

SMZ

Contract price, cents per pound of alloy, f.o.b. shipping point, freight allowed. 60-65% Si, 5-7% Mn, 5-7% Zr, 20% Fe.

	Eastern	Central	Western
Ton lots	12.00	12.85	14.60
Less ton lots	12.50	13.35	15.10

Other Ferroalloys

Ferrotungsten, standard, lump or ¼X down, packed, f.o.b. plant Niagara Falls, Washington, Pa., York, Pa., per pound contained T, 5 ton lots, freight allowed	$1.88
Ferrovanadium, 35-55%, contract basis, f.o.b. plant, freight allowances, per pound contained V.	
Openhearth	$2.70
Crucible	$2.80
High speed steel (Primos)	$2.90
Vanadium pentoxide, 88-92% V_2O_5 technical grade, contract basis, per pound contained V_2O_5	$1.10
Ferrocolumbium, 50-60%, contract basis, f.o.b. plant, freight allowed, per pound contained Cb.	
Ton lots	$2.25
Less ton lots	$2.30
Ferromolybdenum, 55-75%, f.o.b. Langeloth, Washington, Pa., per pound contained Mo	95¢
Calcium molybdate, 40-45%, f.o.b. Langeloth, Washington, Pa., per pound contained Mo	80¢
Molybdenum oxide briquets, 48-52% Mo, f.o.b. Langeloth, Pa., per pound contained Mo	80¢
Molybdenum oxide, in cans, f.o.b. Langeloth and Washington, Pa., per pound contained Mo	80¢
Ferrotitanium, 40-45%, 0.10%C max., f.o.b. Niagara Falls, N. Y., ton lots, per pound contained Ti	$1.23
Less ton lots	$1.25
Ferrotitanium, 20-25%, 0.10%C max., ton lots, per pound contained Ti	$1.35
Less ton lots	$1.40
High-carbon ferrotitanium, 15-20%, 6-8% C, contract basis, f.o.b. Niagara Falls, freight allowed, carloads	$142.50
Ferrophosphorus, 18%, electric or blast furnaces, f.o.b. Anniston, Ala., carlots, with $3 unitage freight equalled with Rockdale, Tenn., per gross ton	$58.50
Ferrophosphorus, Electrolytic, 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage freight equalized with Nashville, per gross ton	$75.00
Zirconium, 35-40%, contract basis, f.o.b. plant, freight allowed, per pound of alloy.	
Carload lots	14¢
Zirconium, 12-15%, contract basis, lump, f.o.b. plant, freight allowed, per pound of alloy	
Carload, bulk	4.60¢
Alsifer, 20% Al, 40% Si, 40% Fe, contract basis, f.o.b. Niagara Falls, carload	6.25¢
Ton lots	6.75¢
Simanal, 20% Si, 20% Mn, 20% Al, contract basis, f.o.b. Philo, Ohio. freight allowed, per pound	
Car lots	8.50¢
Ton lots	9.25¢
Less ton lots	9.75¢

Boron Agents

Contract prices per pound of alloy, f.o.b. shipping point, freight allowed. Ferroboron, 17.50% min. B, 1.50% max. Si, 0.50% max. Al, 0.50% max. C.

	Eastern	Central	Western
Less ton lots	$1.30	$1.3075	$1.329

Manganese—Boron 75.00% Mn, 15-20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C.

Ton lots	$1.89	$1.903	$1.935
Less ton lots	2.01	2.023	2.055

Nickel—Boron 15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni.

Less ton lots	$2.10	$2.1125	$2.1445

Silcaz No. 3, contract basis, f.o.b. plant, freight allowed, per pound of alloy.

carload lots	25¢
Ton lots	26¢

Silvaz No. 3, contract basis, f.o.b. plant, freight allowed, per pound of alloy.

Carload lots	58¢
Ton lots	59¢

Grainal, f.o.b. Bridgeville, Pa., freight allowed, 50 lb and over.

No. 1	87.5¢
No. 6	60¢
No. 79	45¢

Bortram, f.o.b. Niagara Falls

Ton lots, per pound	45¢
Less ton lots, per pound	50¢

Finland's Energetic Procurement Of U. S. Surplus Goods Spurs Recovery

Helsinki

• • • **Finland's steady** recovery program since the end of the war is getting one of its healthiest transfusions from the tens of thousands of tons of surplus U. S. Army and Navy stocks which are being funneled into Finnish trade and rehabilitation channels. American surpluses of every description have been flowing in a constant stream to Finland for the past seven months from U. S. depots in France, Belgium, Norway, and Germany. This is due mainly to the energetic efforts shown by the Finns in buying and promptly taking custody of their stocks.

Office of the Foreign Liquidation Commissioner in Paris announced recently in Helsinki that Finland now had completed contracts for surplus property totaling more than $14,000,000. The property purchased by the Finnish Government originally cost the American taxpayer $20,493,337, and will be paid for over a period of 30 yr with interest at 2 and ⅜ pct annually. Purchases have been made by the Finns against a $15,000,000 credit granted in March and May, 1946.

Finland's procurement of surplus U. S. property to spur the recovery program is one of the brightest chapters in the entire disposal program of left-over war stocks in Europe. These surpluses constitute the first American products to reach Finland in six yr. Included in the initial purchases were 500 trucks, trailers, and jeeps for use in Finnish forests, dismounted engines to provide power for sawmills, 25,000 towing chains to be used for hauling logs, power shovels and engineer equipment to help in Finland's reconstruction program involving six hydroelectric plants, swamp drainage, and land clearing projects.

When OFLC liquidated all U. S. surplus stocks in Norway in February, the Finns bought $2,000,000 worth of equipment and supplies, three fourths of which were made up of quartermaster items, including clothing, underwear, shoes, and special winter gear which the 5000 American troops of "Task Force A" took with them into Norway. Remainder of their purchases from U. S. stocks in Norway included medical and signal equipment, jeeps, and two-and-a-half-ton trucks.

During OFLC's September "over-the-counter" sales program in Belgium, when every item of surplus remaining in U. S. depots and ports there was offered on a "first come, first served" basis, the Finns were on the job early and late. They visited every depot in Belgium during the month and bought more than $4,000,000 worth of surplus stocks before the sales campaign closed. Their purchases included practically everything used by a modern army in the field, except combat equipment. They bought $500,000 worth of trucks and trailers; telephone and telegraph equipment costing over $200,000; pipeline materials, reinforcing steel and accessories totaling $600,000; textiles and clothing which came to $650,000; cocoa, tea, and chocolate for $250,000; more than $150,000 worth of rope; heavy engineering equipment, railroad cars, tractors, and excavators totaling over $500,000, and several thousand dollars worth of miscellaneous items.

There is hardly any phase of the Finnish economy that has not felt the effects of U. S. surpluses in the recovery effort. The Finnish airlines have received eight surplus C-47 transports to reestablish their air networks, and the maritime industry is now using, among other items, 24 surplus U. S. Navy tugs, and two 30-ton floating cranes.

The Finns have been as prompt in taking custody of their surplus purchases, always a disposal problem, as they have been alert in their buying. All surplus property purchased by the Finnish delegation, except those stocks bought during September in Belgium, have now reached Finland.

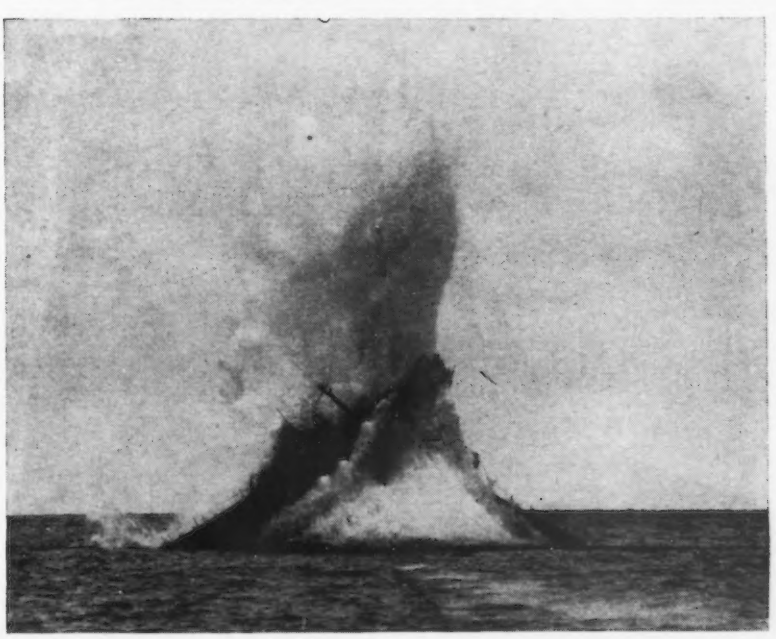
WAA Holds Old Prices

Washington

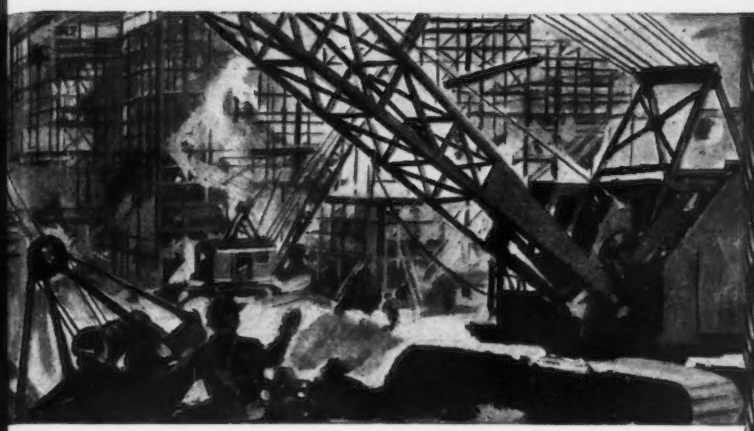
• • • **Price decontrol** has not affected WAA. Administrator Robert M. Littlejohn has announced that the surplus property agency will adhere to its old price schedules.

"The WAA will help hold the line by continuing its policy of fair prices for government surplus property," said General Littlejohn.

SUB SINKS SWIFTLY: *Hit amidships by a standard steam type torpedo fired at 1000-yd range in a test off Cape Cod, the captured German submarine U-977 broke in two and disappeared in 10 sec.*



PAINTED FOR JONES & LAUGHLIN STEEL CORPORATION BY ORISON MACPHERSON



WITHOUT STEEL WIRE ROPE— CONSTRUCTION WOULD DEPEND ON SLOW, COSTLY LABOR OF MEN AND BEASTS

Without steel wire rope, construction would still be done by slow, costly, antiquated methods. Use of these old methods would prevent the undertaking of present-day projects of great magnitude. Construction jobs, of necessity, would be small and local. The burden of all the heavy work would still be placed upon men and beasts.

Today, huge machines of steel perform the miracles of construction you see all about you. They work easily, swiftly, irresistibly, yet seemingly without effort. Strong, sinewy, flexible, steel wire rope controls and transmits their tremendous power.

Tomorrow the work of moving mountains, filling valleys, damming rivers, dredging channels, building bridges, erecting buildings will go forward at an even faster pace. Larger, more powerful machines controlled by wire rope will enable greater marvels of engineering achievement — thanks to wire rope, such as the Precisionbilt ropes made by Jones & Laughlin Steel Corporation from J&L Controlled Quality steel.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

CONTROLLED QUALITY STEELS

(Advertisement)

WITH ROPES OF STEEL

Biggest earth moving job, 75 million cu. yds., forming 2 mile embankment will be involved in building Garrison Dam on the Missouri River above Bismarck, S. D. Dirt will all be handled by big shovels, scrapers and earth movers, directed and controlled by steel wire rope.

First skyscraper (12 stories) was Home Insurance Bldg., Chicago, erected 1888.

World's highest buildings all in U. S. — Highest is Empire State with 102 stories towering 1,250 feet. There are 55 buildings over 500 feet high in New York and 10 other cities, which would have been impossible to erect without wire rope.

World's 2nd largest air field, 1,600 acres, is the new Greater Pittsburgh airport, now under construction by the Board of Commissioners of Allegheny County, Pennsylvania. Only New York's Idlewild Field, also under construction, will be larger. Pittsburgh field will be completed in 1948 at a cost of $25 millions. More than 3,000,000 cubic yards of earth and rock will be moved with powerful steel-built equipment, most of it controlled by steel wire rope. Pittsburgh airport with 8 runways 150 ft. wide, 6,000 to 9,600 feet long, will load 30 planes at one time, handle planes in and out every 30 seconds.

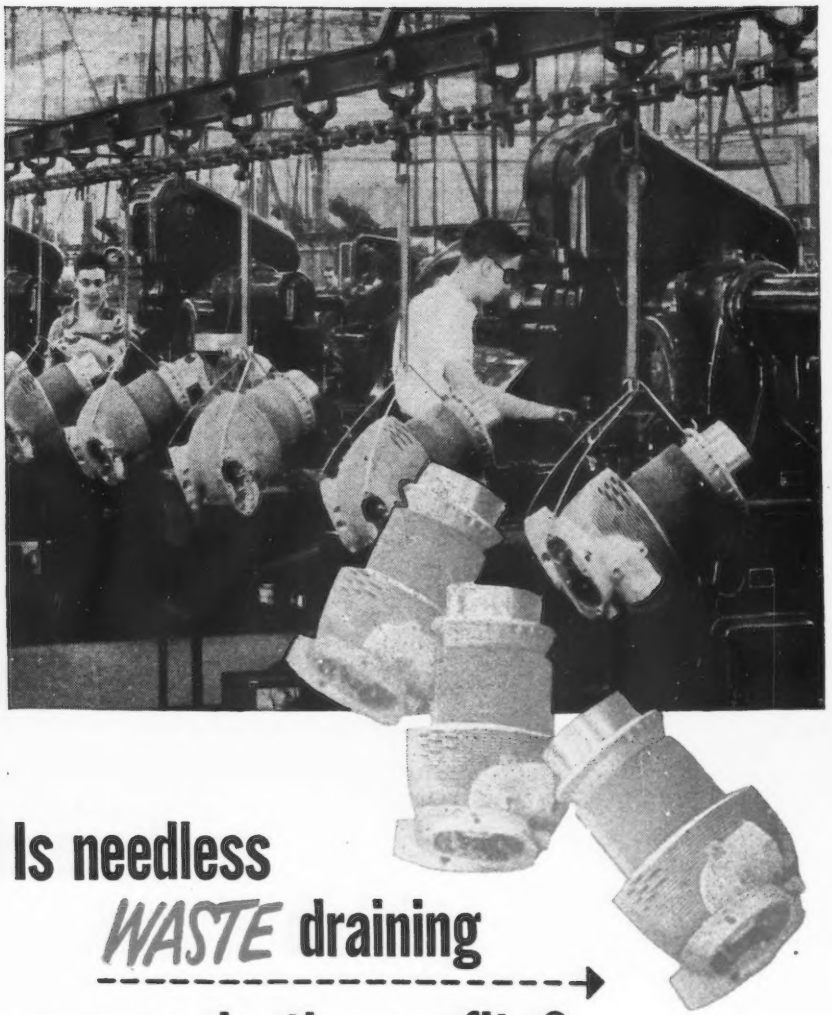
1,607,000 miles of the 3⅓ million miles of roads, streets and alleys in U.S. are paved.

200,000 new irrigated farms and reclamation of drought areas on 10,000,000 acres are projects of U. S. Bureau of Reclamation. Those already authorized by Congress will employ 400,000 workmen.

Notable bridges of United States are Golden Gate over San Francisco Bay, a suspension bridge with channel span of 4,200 feet; the Huey P. Long, over the Mississippi River at New Orleans, a cantilever bridge with channel span of 3,524 feet; the Bayonne over Kill Van Kill River, New York City, a steel arch bridge with channel span of 1,675 feet; the Castleton over Hudson River, in New York State, a simple truss bridge with channel span of 1,008 feet; and the Martinez at Suisun Bay, California, a vertical lift bridge with a horizontal clearance of 291.5 feet.

Largest concrete dam in world is Grand Coulee, in Washington, 550 feet high, 4,173 feet long and creates a lake 151 miles long.

Preforming wire rope reduces strains as wire and strands are bent and permanently set into helical shape they take in the finished rope. This makes a very flexible, "relaxed" rope which is easier to handle and longer wearing. When cut, preformed wire rope does not ravel. Wires broken in service lie flat, do not catch worker's hands and clothing. For more information about J&L Permaset Preformed Wire Rope write Publicity Manager, Jones & Laughlin Steel Corporation, Pittsburgh 30, Pa.



Is needless
WASTE draining
your production profits?

Faulty lubricants can cause rejects which drop right out of the profit picture. But *you* needn't be in doubt about profit-protection. Use the *right* lubricants...Penola Industrial Lubricants. They can handle every lubricating job in your business, efficiently.

Penola Lubricants are the product of long research, developed in America's largest petroleum laboratories. Their quality is uniform... their service, dependable.

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PENOLA PRODUCTS HAVE MEANT EXTRA PROTECTION SINCE 1885

Announces Standard Design for Light Gage Steel for Construction

New York

• • • **Official industry** standards for light gage steel which will make possible broader uses of the material in certain types of building construction, were announced here recently by the American Iron & Steel Institute.

The comprehensive "Specification for the Design of Light Gage Steel Structural Members," issued by the institute, is the result of studies begun in 1939 under the building code committee of the institute.

According to B. L. Wood, consulting engineer of the committee, research work has been carried on intensively and continuously at Cornell University for more than 7 yr, under the direction of Dean S. C. Hollister of the College of Engineering, professor W. L. Malcom, director of the School of Civil Engineering and Dr. George Winter, associate professor of civil engineering, in immediate charge of research.

The program has had as its objective a study of the behavior of light steel structural members under load and the proper proportioning of such members. It has included a study of available engineering literature on the subject, supplemented by tests on beams, studs or light columns and panel or deck constructions involving nearly 700 structural specimens.

R. E. Zimmerman is chairman of the building code committee, of which a technical subcommittee under the chairmanship of Milton Male directed the research work and prepared the specification.

Pullman-Standard Car Builds New Streetcars

Chicago

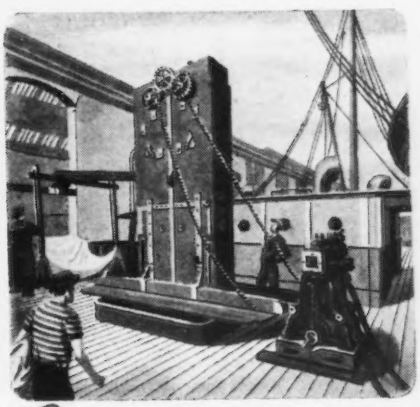
• • • **Two 88-ft,** articulated cars of three compartments each, are being built for the Chicago Rapid Transit Co. at the car works plant of Pullman-Standard Car Mfg. Co. Built of light weight aluminum bodies with steel center sills and draft sills, the cars are designed to stand buffeting stress of 200,000 lb without damage to the equipment.

The cars will be effectively in-

Old Reliable Red Band says—

"Grain goes to bed on an endless chain!"*

1 Early American settlements had community granaries like those of Biblical times for winter storing of grain. In 1834, the first modern grain elevator was built in Buffalo. By 1866, bulk handling of grain was an established industry.



2 Chains of buckets were run, by cumbersome ropes and countershafts, from one central power source on the ground floor. In 1896 came the biggest improvement to date—individual motors were developed to drive each conveyor unit separately.

3 Today, with electrical horsepower, a Buffalo grain elevator can unload grain from lake carriers at the rate of 85,000 bushels an hour. Howell has been building specialized motors for grain elevators and other industries since 1915.

Have you a hard job for Horsepower?

Perhaps you have a process where extremely high or low temperatures exist—excessive moisture—high starting torque—or just a real tough job for a motor. Then get a protected industrial type motor that's built to "take it."

Here's why industrial type Howell Motors stand up:

(1) Precision-built of finest materials, with copper or bronze rotors, and completely insulated.

(2) Smooth-operating because statically and dynamically balanced.

(3) Designed for the toughest tasks in industry—consequently better-performing on *all* jobs.

See your nearest Howell Representative for your needs in specialized or standard motors up to 150 h.p. Remember, you pay no more for industrial type Howell Motors—and you always get top quality for your money.

Howell Protected Type Motors available in sizes 5 h.p. and smaller. Also other sizes of Howell industrial type motors available up to 150 h.p.

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Manufacturers of Quality Industrial Type Motors Since 1915

Clean
Steel Parts
Before
Organic Finishing
With
NEW OAKITE
WATER-MIXED
SOLVENT

GET safer and more economical removal of light oils, shop dirt and non-pigmented stamping compounds from steel or aluminum parts by introducing two-percent-by-volume solutions of

Oakite
Composition No. 98

in your pressure-spray washing machine. Water-mixable, this non-toxic solvent employs the principle of "constant-float protection" to prepare thoroughly clean pre-finishing surfaces. Lighter-than-solution soil floats at the top of the cleaning tank, blankets and protects the clean solution underneath.

This new, self-emulsifying solvent retards foaming . . . prevents evaporation losses . . . banishes water spots that often show through clean work. Ask your local Oakite Technical Service Representative for a FREE copy of the Special Service Report on the new cost-lowering metal cleaner! Report describes field tests, gives temperature and working-concentration details. Write on letterhead TODAY!

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Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* CLEANING
MATERIALS • METHODS • SERVICE

sulated against heat, noise and vibration, with special forced draft ventilating systems to insure fresh air at all times. Each compartment of the cars will have a set of double doors at each side located in the center to speed the handling of passengers in loading and unloading. The cars will be capable of a speed of about 45 miles per hr and will be equipped with an outstanding safety feature in three distinct braking systems. Beside the usual brake on the motor, a drum brake on the drive shaft will work automatically and an electro-magnetic brake shoe can be used for emergency stops.

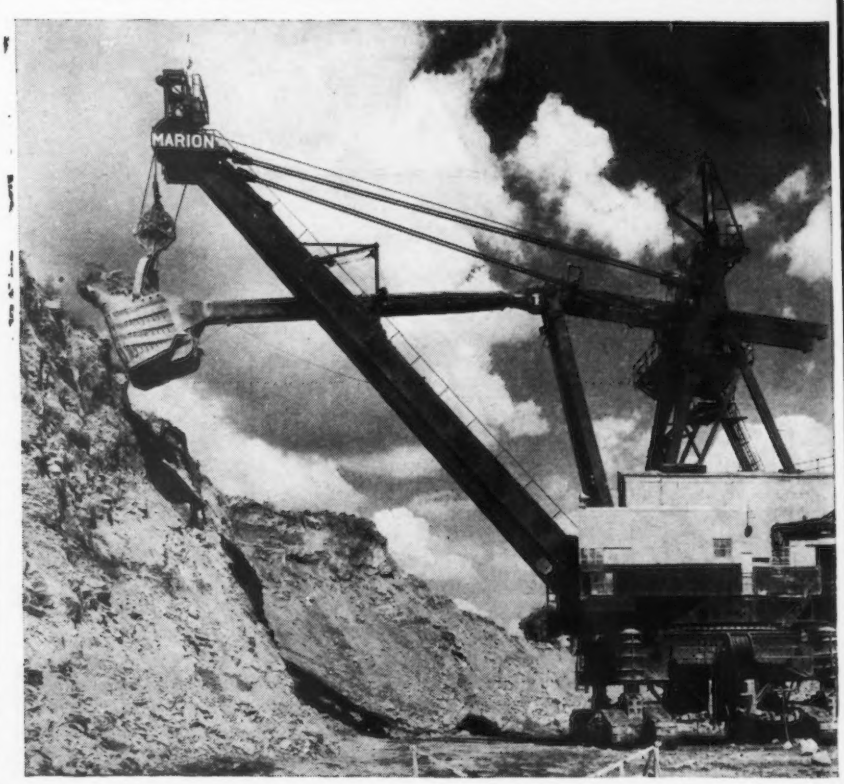
Bureau of Mines Soon To Release New Films On Steel and Nickel

Washington

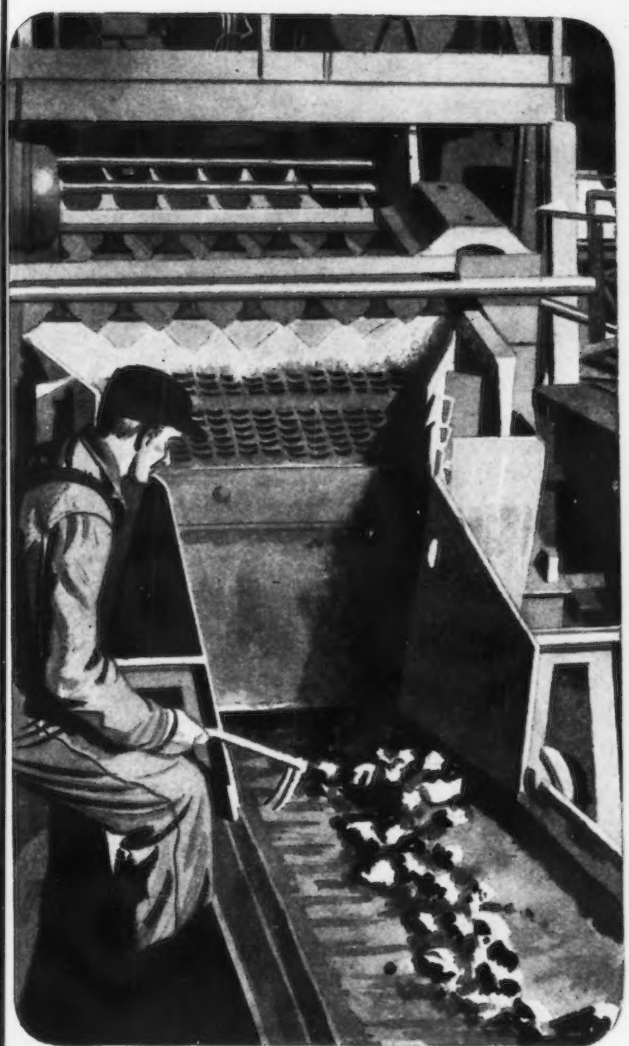
• • • **"The Drama of Steel,"** a brand new film and "The Story of Nickel," a revision of an earlier film, have been completed by the Bureau of Mines and will be released this year. Five of the 15 films being added to the free loan library of the Bureau are about aluminum, with one entitled "This is Aluminum" and depicting aluminum from mine to product. The other four deal with welding and brazing aluminum metal. These pictures are practically completed and are expected to be released within the near future. "The Fabrication of Copper," about ready for release, is another of the group of films dealing with mining, minerals and petroleum which Secretary of the Interior Krug has announced have been authorized for 1946.

Setting an all-time record in the amount of funds provided by cooperating industries in any one year, the $403,250 appropriated for the Bureau's films in 1946 represents $350,000 for the production of new pictures and $52,250 for extra sets of prints of several of the films, Secretary Krug was advised by Dr. R. R. Sayers, Bureau Director. The total of funds provided by industry in the 30 yr from 1916 to 1946 has reached approximately $2,250,000.

LARGE MOUTHFUL: *The 40 cu yd bucket developed by the Marion Power Shovel Co. in action. Built of low alloy high strength steel the decreased weight of the all welded bucket permits removal of 10 cu yd more earth than the old equipment.*

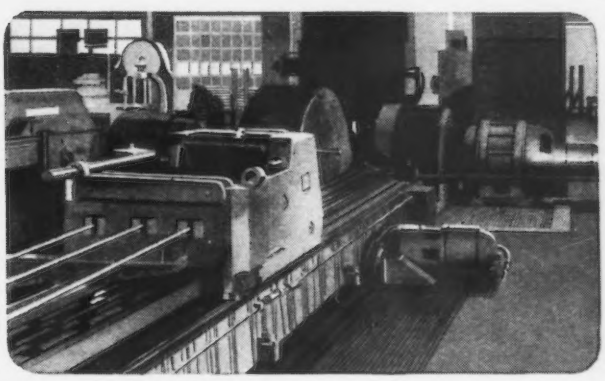


Watch industry Fluid-Drive* ahead!



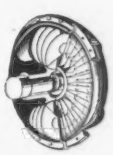
1 Smelting. Follow ore from mine to finished product. Gýrol Fluid Drive has a job at almost every stage. In smelting it protects motors powering conveyors, crushers and rotary kilns. On mechanical draft equipment, Gýrol Fluid Drive is also utilized for adjustable speed control.

2 Steel. Gyrol Fluid Drive is the answer to a steel mill's needs for protection of such important machines as chargers, conveyors, drawbenches, cranes, as well as other A. C. and D. C. equipment.



3 Metal Working. With Gýrol Fluid Drive, adjustable speed control — from dead stop to full speed — is obtained while using simple, constant speed AC motors. A vortex of oil handles the pull with smooth, even tension. Here's an ideal condition for drawbenches.

4 And You? Industry has found a multitude of uses for Gýrol Fluid Drive. *New applications are being discovered almost daily!* Do they apply to you? Let's investigate the matter together.



AMERICAN BLOWER

AMERICAN BLOWER CORP., DETROIT 32, MICH.
In Canada: CANADIAN SIROCCO CO., LTD., Windsor, Ont.
Division of American Radiator & Standard Sanitary corporation

* ***Gýrol Fluid Drive*** *is a fluid power transmission pioneered and developed for American industry by American Blower. It is used wherever smooth transmission of power or stepless adjustable speed control is desired. Looking beyond the long list of applications already developed, we will gladly work with you to find new ways to "Fluid Drive Ahead!"*

AJAX
FLEXIBLE
COUPLINGS
Ajax design permits installation
vertically or at any angle. No lubrication.
Remember that all the horsepower goes
through the coupling...put it up to Ajax.
AJAX FLEXIBLE COUPLING CO. INC., WESTFIELD, N. Y.

London Economist

[CONTINUED FROM PAGE 119]

present year. The decrease in the yield from direct taxes is explained by the abolition of special wartime taxes at the end of 1945.

On the side of expenditure, the chief interest attaches to the cut in defense expenditure. In 1945 actual expenditure on defense was 10 billion roubles less than the estimate; and the sum of 128 billion included gratuities paid out to ex-servicemen—the proportion as between gratuities and spending on actual defense has not been disclosed. This year the budget of the Ministry of the Armed Forces has been cut by 56 billion roubles. Nominally this is still 16 billion roubles higher than it was in 1940; but in view of the depreciation of the rouble the real expenditure is probably quite considerably lower.

A sequel to the drastic reduction in defense expenditure is the impressive increase in the grants for national economy and social services. Capital construction in heavy industries is usually financed mainly from the grants for national economy; and so the funds allocated to national economy give some measure of the rate of industrial expansion. Nominally that rate is now planned to be twice as large as in 1940, and more than three times larger than in 1943; but the validity of the comparison is, here again, diminished by the uncertainty as to the real value of the rouble. The same applies, of course, to increased expenditure on social services.

The table below gives some insight into the order of priorities according to which the funds for capital construction are distributed between the various branches of Soviet economy:

(In billions of roubles)

	1945	1946
Total fund	74.3	102.2
Industry	43.9	63.8
Agriculture	9.1	12.5
Transport and communications	9.8	10.8
Trade and accumulation of stocks	2.1	3.1
Municipal services	2.3	3.8

The budget reflects the great work of economic reconstruction on which the Soviet Union has embarked. Russian propagandists have underlined with some emphasis the peaceful character of the budget. The drastic cut in defense expenditure and the obvious

[CONTINUED ON PAGE 147]

concentration of economic energy on the rebuilding of the devastated provinces lends strong support to this line of official Soviet propaganda. The fact that defense is still absorbing 23 pct of the total expenditure constitutes, nevertheless, a heavy drain on the Soviet Union's economic resources. But in the present atmosphere of international tension the Soviet Government has apparently not thought it possible to reduce the burden of military expenditure more drastically than it has done.

Top Rank Scientists To Speak in March At Western Metal Show

Cleveland

• • • **The best practical** and technical program ever presented to the metal industry at a Western Metal Congress is taking shape, according to Dr. John E. Dorn, Associate Professor of Metallurgy, University of California, Berkeley, and chairman of the program committee of the Congress which will be held at Oakland Municipal Auditorium, March 22-27, 1947.

"Some of the most outstanding scientists and research investigators of the United States have accepted invitations to appear on the program," said Dr. Dorn. "The program will cover practically every phase of the manufacture, production, fabrication, inspection, testing, welding and use of metals."

Assisting Dr. Dorn in the work of the program committee are Prof. Cutler Shepard of Stanford University and Fred Donlevy. Caterpillar Tractor Co., San Leandro, vice chairmen of the committee, together with representatives of the 15 national technical and engineering societies having branches in the West that are cooperating in the Congress.

The Western Metal Exposition, which will be held simultaneously with the Western Metal Congress, has already received applications from more than 100 leading metal manufacturers of the East and West for participation in the exposition, which will occupy over 100,000 sq ft of space. This is the fifth Western Metal Congress and Exposition held under the auspices of the American Society for Metals.

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Many of our customers have reported that impressive reductions in polishing costs result when they switched to LIONITE Abrasive Grains for their set-up wheels. We have actual figures showing the savings in a variety of polishing operations. The quality of the finish is frequently improved at the same time.

LIONITE representatives have had wide experience in all phases of metal polishing. They are at your service to survey your polishing procedure and submit recommendations. There is no obligation. If you are not entirely satisfied with costs or quality in your polishing department, ask to have a LIONITE representative call.

GENERAL ABRASIVE COMPANY, INC.

Lionite and Carbonite Abrasive Grains

NIAGARA FALLS, NEW YORK, U. S. A.

Gallup Polls

(CONTINUED FROM PAGE 115)

fore election day among voters of different ages.

The figures show voting sentiment in May and in November, just before the election. The figures exclude the South, where elections are largely settled by primaries, and Maine and California, where elections were either held early or were to an important extent settled by primaries.

	Republican Pct November	Republican Pct May	Change
Age			
21-29	51	40	+11
30-49	61	49	+12
50 and over	64	60	+ 4

Veterans of World War II likewise shifted from Democratic to Republican, the poll indicates.

VETERANS

	Republican Pct November	Republican Pct May	Change
Veterans	55	47	+ 8

The change of political sentiment was about the same among women as among men, with the women showing a somewhat more extensive shift.

	Republican Pct November	Republican Pct May	Change
Men	61	53	+ 8
Women	59	48	+11

•

• • • **The Democrats** suffered serious losses in the big cities.

These cities (with populations of 500,000 or more) have been the traditional strongholds of the Democratic Party outside the Solid South. It was in these areas that the Democrats rolled up such impressive majorities during the Roosevelt era.

In its 1946 pre-election analysis, the Gallup Poll pointed out that the Democrats were destined to suffer their keenest losses this year in the large cities—New York, Philadelphia, Boston, Baltimore, Buffalo, Pittsburgh, Cleveland, Detroit, Chicago, Milwaukee. St. Louis, San Francisco, and Los Angeles.

What happened in the great metropolitan sections can be appraised from three points of view: (1) The division of the votes cast —How many voted Democratic; how many Republican. (2) What effect the division of the vote had upon the seats in the Congressional elections. (3) The turnout in the big cities.

The extent of defection from the Democratic Party among city voters in Congressional elections is eight points since 1944.

Following is a table showing the trend of Congressional voting in the 13 big cities, taken as a group:

	Democratic Pct	Republican Pct
1944	60	40
1946	52	48

The shift between 1944 and 1946 is spelled out dramatically in the total Republican gain of seats in the districts affected by the big city vote.

The Republicans needed to pick up 26 additional seats, over and above what they had going into the elections, in order to take over control of House of Representatives.

In districts embraced by the 13 large cities (one half or more of the population of the districts within a city), the Republicans picked up 23 seats.

They picked up six more in cities between 100,000 and 500,000 population so that, actually, the Republicans were given the necessary seats to take over control of the House by the voters in the large cities alone.

The picture is best shown in table form:

13 Largest Cities	Won by Dems.	Won by Reps.
1944	57	9
1946	34	32

How successful were the big city machines in turning out the vote? The answer to this question may hold clues as to how effective a job they will do in 1948, when the presidency is at stake.

Indications to date are that the machines could have done a far better job than they did in herding voters to the ballot boxes election day. On the basis of returns from about three fourths of the districts affected by the big city vote, the turnout is down about 25 pct from 1944.

The drop-off in the 13 large

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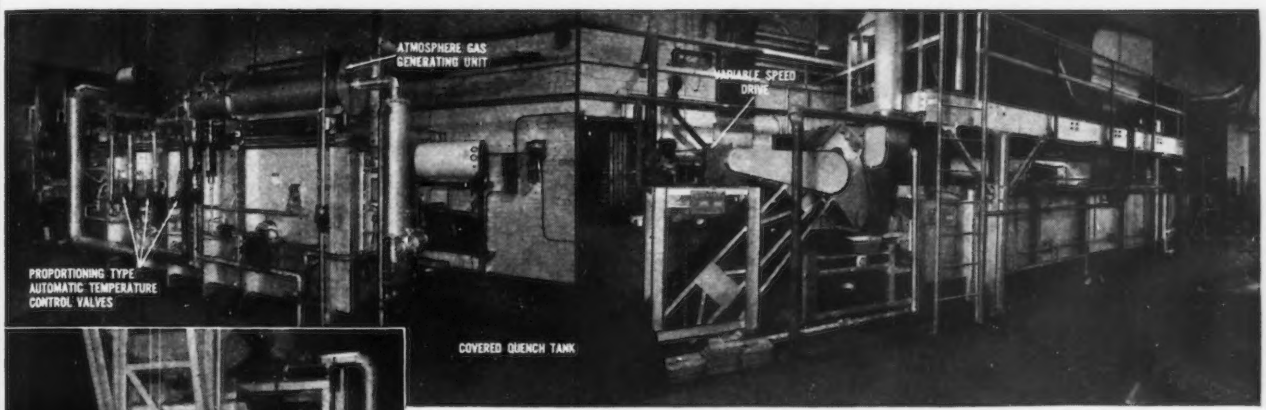
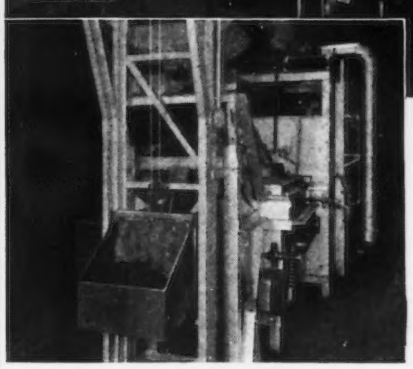
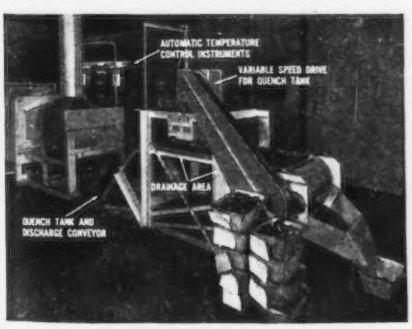
at the Allen Manufacturing Company, Hartford, Conn.


ATMOSPHERE GAS GENERATING UNIT
VARIABLE SPEED DRIVE
PROPORTIONING TYPE AUTOMATIC TEMPERATURE CONTROL VALVES
COVERED QUENCH TANK

New Sunbeam Stewart Fully Automatic and Completely Atmosphere Controlled Continuous Hardening, and Tempering Installation at the Allen Manufacturing Company. This furnace does work that formerly required six rotary furnaces . . . eliminates the expensive degreasing operation between hardening and tempering.



Loading end of the Sunbeam Stewart Atmosphere Controlled Hardening Furnace, showing bucket hopper designed by Allen engineers to save labor and insure uniform loading.


AUTOMATIC TEMPERATURE CONTROL INSTRUMENTS
VARIABLE SPEED DRIVE FOR QUENCH TANK
DRAINAGE AREA
QUENCH TANK AND DISCHARGE CONVEYOR

Discharge end of the Sunbeam Stewart Draw Furnace. The work has a clean, scale-free surface and a uniform, deep carbon-black color.

For the important job of securing hard and tough structure together with a uniform deep carbon black color for their famous Hex-Socket screws, the Allen Manufacturing Company chose a Sunbeam Stewart Fully Automatic and Completely Atmosphere Controlled Continuous Hardening, and Tempering Furnace Unit.

This Sunbeam Stewart installation has simplified Allen's heat treating process. It has replaced a gang of rotary furnaces and overcome an expensive degreasing operation between hardening and tempering.

Allen Hex-Socket screws, etc., are conveyed through the Sunbeam Stewart Atmosphere Controlled Hardening Furnace. The load then drops into the conveyorized Quench tank. Next, a conveyor carries the load through the Sunbeam Stewart Atmosphere Controlled Draw Furnace. The load now drops into a second quench tank, and another conveyor carries it to the discharge. These Sunbeam Stewart furnaces are designed to operate on manufactured gas and have a capacity of 800 lbs. per hour. All fuel, air, cooling liquids and the furnace atmosphere are under automatic control.

This installation is typical of the industrial furnaces Sunbeam Stewart engineers are building every day to meet the specified requirements of manufacturers all over the continent. In addition, Sunbeam Stewart builds a full line of standard furnaces.

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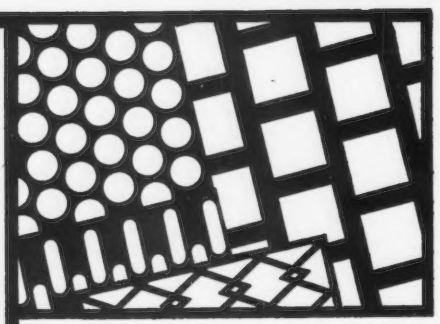
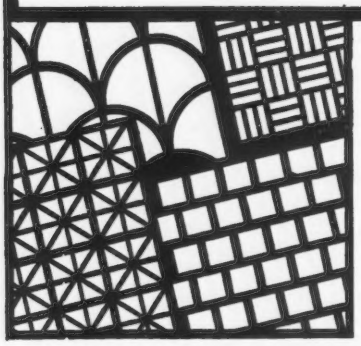
(*Formerly* CHICAGO FLEXIBLE SHAFT CO.)

Main Office: 4433 Ogden Ave., Dept. 110, Chicago 23, Ill.—*Canada Factory:* 321 Weston Rd., So., Toronto 9

A letter, wire or 'phone call will promptly bring you information and details on SUNBEAM STEWART furnaces, either units for which plans are now ready or units especially designed to meet your needs. Or, if you prefer, a SUNBEAM STEWART engineer will be glad to call and discuss your heat treating problems with you.

PERFORATED METALS
for every industrial use





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Our Shot and Grit were made expressly for use in airless machines.

It simply means—
More cleaning at much less cost.
More cleaning and less dust at less cost.

And, remember—any old size won't do.

There is a correct size of Shot and Grit to obtain maximum results.

If cleaning grey iron, malleable iron, or steel drop forgings, we can save you money.

Let us prove it!

HARRISON ABRASIVE CORPORATION
Manchester, New Hampshire

cities from 1944 would thus appear to be about the same as it was throughout the nation as a whole.

Political experts would quickly agree that the vote in the big cities, with their highly geared machine operations, should not have been off to the same extent as the entire nation—at least not if the machines were operating with their old-time efficiency.

Coal Burning Turbine Unit for Locomotives Will Be Tested in West

Washington

• • • **Full scale operational** tests of the combustion apparatus and fly ash separators for the revolutionary coal-burning railroad gas turbine will be made at the Kaiser steel mill at Fontana, Calif. These tests will advance the prospects for the bituminous industry to launch a locomotive powered by coal which can out-perform the oil-burning diesel motive power on railroads.

John I. Yellott heads the locomotive development project, which is financed jointly by coal operators and several railroads. The tests at Fontana will be done in cooperation with the Northrop-Hendy Co., a subsidiary of Northrop Aircraft and Joshua Hendy Machine Works.

The steel plant in California is presently the only available source for compressed air in the great quantity needed for the powdered-coal burning combustion tests, according to Mr. Yellott. Full-scale equipment is expected to be built in the East this winter for burning pulverized coal under pressure at a rate of 3000 lb per hr. It will then be transported to the steel works at Fontana, Calif.

The tests are intended to provide actual operating experience on the equipment for the two experimental gas turbine locomotives soon to be built. Gas turbines of 3750 shaft hp are being constructed by the Allis-Chalmers Mfg. Co., and the Elliott Co. Such preliminary testing in California of the combustion equipment should enable the gas turbine locomotives to go on the rails early in 1948, according to Mr. Yellott.

MERCURY
FORK TRUCKS
2000, 4000, 6000 LB. CAPACITIES

MERCURY "JEEP":
Powerful—yet the most compact fork truck made. Ideal for smooth operation in confined areas. 2000 lb. cap.

Rugged, easily maneuvered and round-the-clock dependability—a cost reduction combination engineered into every Mercury fork truck!

By handling more tonnage with greater ease, spotting loads quickly and accurately, tiering to ceiling height—Mercury fork trucks conserve manpower, economize on storage space and speed the flow of materials.

Consult Mercury—learn how these handling economies can serve you. Write for Bulletin 201-6, containing complete description of the full Mercury line, or ask a Mercury Sales Engineer to call.

These Features, Pioneered and Perfected by Mercury, are Standard on all Mercury Fork Trucks—

HYDRAULIC HOIST:
Less than 50% of the usual moving parts.

ALL-WELDED FRAME:
No rivets to weaken sections.

SNAP-ACTION CAM OPERATED CONTROLLER:
Eliminates injurious arcing.

UNIT CONSTRUCTED DRIVE ASSEMBLY:
Motor and drive are one unit.

MERCURY "YAK":
Next in tonnage capacity is the "Yak." Ruggedly designed for continuous heavy duty. Handles loads up to 4000 lbs. with ease.

MERCURY "YANK":
Most powerful fork truck in the Mercury line. Built for severe service and unusually heavy loads. 6000 lb. cap.

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• • • *By Using a Hoist That Stays On The Job Longer—With Fewer Moving Parts To Maintain!*

There are only four moving parts in the hoisting unit of a *Reading* Electric Hoist. To you this means fewer wearing parts—lower replacement costs. And because each of the hoist units can be individually removed for routine inspection or overhauling, maintenance time and expense are kept at a minimum.

Decide today to get fast, low-cost material handling with *Reading* Electric Hoists. Contact your nearest *Reading* Hoist distributor, now. Also, drop us a line for your free copy of "144 Answers To Your Hoisting Problems."

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NMTA Favors Repeal Of Wagner Labor Acct; Says Fails Its Purpose

New York

• • • **The National Metal Trades Assn.** meeting here for its 47th annual convention went on record in favor of repeal of the Wagner National Labor Relations Act. The act has failed in its purpose to diminish labor disputes, a unanimous resolution of the association declared.

"It has become the instrument by which a few labor union leaders have been enabled to nullify the freedom of millions of workers. It has deprived employers of equality before the law in the use of their properties. It has permitted irresponsible labor union leaders to regiment forces so powerful as to jeopardize the welfare and future of all the people of the nation," the resolution stated.

The resolution adopted by the 600 delegates declared that the association will support legislation which embodies the following principles: "(1) The right of every worker to deal with his employer by collective bargaining through any agency he chooses; (2) the right of every worker to deal with his employer directly as an individual, if he chooses; (3) the right of every individual to work or not, as he chooses; (4) the right of every individual to go to and from his work unmolested; (5) equality under the law and the protection of minority rights; (6) monopolistic activities of all groups whether employer or employee, must be controlled in the public interest."

Senator Albert W. Hawkes, Republican of New Jersey, urged repeal of the Wagner Act during his address at a luncheon session.

"In my opinion the National Labor Relations Act should be repealed," he said, "and in its place should be enacted a fine piece of legislation conceived in the interests of management, the public, workers and other factors." He suggested that a waiting period of 10, 20, or 30 days be required for disputes affecting public utilities.

The National Labor Relations Act was never intended to be as one-sided as it turned out to be, Senator Hawkes declared. Nothing that destroys the legitimate powers of management to manage is of benefit to any worker, he explained.

Stabilization of production and employment was stressed by Clarence B. Randall, vice president, Inland Steel Co., Chicago, who emphasized the importance of manufacturers placing their own house in order before criticizing others. He said purchasing agents could do more to encourage stabilization by not pressing their advantages excessively in buying industrial materials.

Mr. Randall cautioned members against sending a lawyer to substitute for management at the bargaining table during wage negotia-

NEW INSTRUMENTEURS: *Officers recently elected by the Instrument Society of America at its first national conference are: Back row (left to right): Hugh Ferguson, treas. Richard Rimbach, executive secretary; J. B. McMahon, vice-president. Front row (left to right): Carl Kayan, first vice-president; H. Barnum, vice-president; Albert F. Sperry, past president; C. O. Fairchild, president; Ralph Munch, vice-president.*

tions. He described the lawyer at the bargaining table as an anomaly and asserted that management will never have satisfactory adjustments of wage problems until the manager who lays down the actual wage policy participates in negotiations.

Unionization of foremen was cited as a major current problem of management in the address of H. J. Post, managing director of the National Assn. of Foremen. He called on top management to make certain that foremen feel that they are part of the management team and said that many training programs have failed because management has failed to remember that foremen are human beings.

Four common errors which occur in management-foremen relations were described by Mr. Post as: (1) By-passing foremen in grievance procedures; (2) failure to give foremen needed information on contracts, schedules, policies, etc; (3) failure to permit foremen to make decisions, and (4) failure to back up foremen in their work. He advocated giving foremen the management tools they need to do their work.

Management must be free to manage and "must not permit any encroachment upon its necessary functions and responsibilities," Henry W. Jones, Jr., president of the American Tube Bending Co. of New Haven, told the convention. Mr. Jones warned that labor unions intend to continue to use collective bargaining to expand into the field of management, and declared:

"Such a philosophy means only one thing—joint management of enterprise. This, management should not and must not accept."

Mr. Jones asserted that management in the public interest "cannot compromise" its rightful functions.

"Once you lose the management control and operation of your business," he said, "you will suffer an irreparable loss and the industrial progress of this country will be arrested.

"You as managers of industry are the trustees of these principles and I am sure that the American public, who are investors in our enterprise system, look to you to preserve these fundamentals of our industrial economy."

"Our 11 BAKER TRUCKS *have given us* CONTINUOUS 24-HOUR SERVICE for 4 YEARS"

CASE HISTORY OF THE THOMPSON AIRCRAFT PRODUCTS COMPANY

Routine periodic inspection and lubrication pays substantial dividends in the operation of Baker Trucks at Thompson Aircraft Products Company's mammoth new Cleveland plant.

Here is a good example of what can be expected of Baker Trucks in the way of *continuous operation,* when properly cared for. According to N. J. Shibley, Superintendent of Building and Property Maintenance at Thompson, their Baker Crane Truck and ten Baker Fork Trucks are as good as new after serving three shifts per day for nearly four years —the equivalent of 12 years of normal service. No truck has been overhauled, there have been only a few minor mechanical failures, and maintenance has been almost negligible.

Actual time out of service averages less than ½ hour per day, per truck, divided as follows:

Daily check of Hydraulic System	5 min.
Battery changes (2 min. each shift)	6 min.
Weekly lubrication (45 min.)—per day . . .	7 min.
Other maintenance (Tires, brakes, inspection and adjustment of electrical controls, etc.) 45 hours per month for 11 trucks—per day	10 min.
Total .	28 min.

Except for the above and for a ten minute period between shifts when trucks are idle, they have been giving "round-the-clock" service for four years and, says Mr. Shibley, "if we continue to take good care of them, they should last indefinitely." That's *Continuity!*

To help you keep your Baker trucks operating continuously and to insure long life, write for "Industrial Truck Care Pays You Dividends."

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All Atlas Coke Oven Equipment is of heavy-duty construction permitting the peak operating conditions required in today's stepped-up production schedules. As a result of years of experience, Atlas is able to design and build equipment, to meet the requirements of each particular coke plant. Detailed information available on request.

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ENGINEERS MANUFACTURERS

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Current WAA Offering Includes One Detinning Plant and a Coal Mine

Washington

• • • WAA has announced that the following plants are being offered for sale or lease:

Detinning plant, Birmingham, Ala., operated during the war by the Johnston & Jennings Co. The project was designed for recovery of tin as tin oxide and black steel scrap from tin cans. It has a monthly capacity of 20,000 tons.

Plant near Fairmont, W. Va., operated during the war by the Westinghouse Electric & Mfg. Co., for the production of radio transmitting tubes, radio equipment and related electronic equipment.

Plant, Milwaukee, operated during the war by the A. O. Smith Corp., suitable for a variety of light manufacturing purposes.

Permanent-type hangar building with adjoining parkway area, near Wichita, Kans., designed for aircraft production and formerly operated by the Beech Aircraft Corp.

Modern Steel Castings plant, Shreveport, La., operated during the war by the J. B. Bearid Co.

Plant, Bowling Green, Ohio, formerly operated by the Daybrook Hydraulic Corp., for the manufacture of pontoon devices.

Coal mine, Wilkeson, Wash., and Coke plant, Tacoma, Wash., formerly operated by the Wilkeson Products Co. Unreserved coal supplies estimated as high as 18,000,000 tons. Coke plant, with 17 regenerative ovens, has a rated annual capacity of 75,000 tons of coke, 900,000 gal of tar and 400,000 cu ft of gas.

Corn State Bidders Buy Mats for Corn Crib Use

Washington

• • • Forty successful bidders have been awarded 4,196,262 sq ft of surplus steel airplane landing mats earmarked for use in seven Corn Belt states as emergency corn storage cribs, WAA has announced. The disposal of the 40 buyers will return $125,887 to the government. Thirty-five acceptible bids asking for one to five carloads will be filled in the amount requested. Three

bidders wanting more than five carloads were cut to five carloads, and two bidders were granted 13 carloads each in the interest of wide and rapid distribution. One bidder sought to buy the entire amount.

The mats, located at Kankakee, Ill., will be shipped to the purchasers in carload lots by the WAA Chicage regional office upon completion of the contracts. Allocation of the awards was made by the Washington WAA office.

The mats consist of steel welded wire fabrics of five-gage wire with 3 in by 3 in mesh in sections 7 ft, 3 in by 77 ft. A price of 3¢ a sq ft was established. The total weight of the mats is 4,112,337 lb. The rolls of 560 sq ft weigh 549 lb. At an average of 84 rolls to the freight car, the stockpile at Kankakee will make 89 carloads.

Westinghouse Reports Third Quarter Output

Pittsburgh

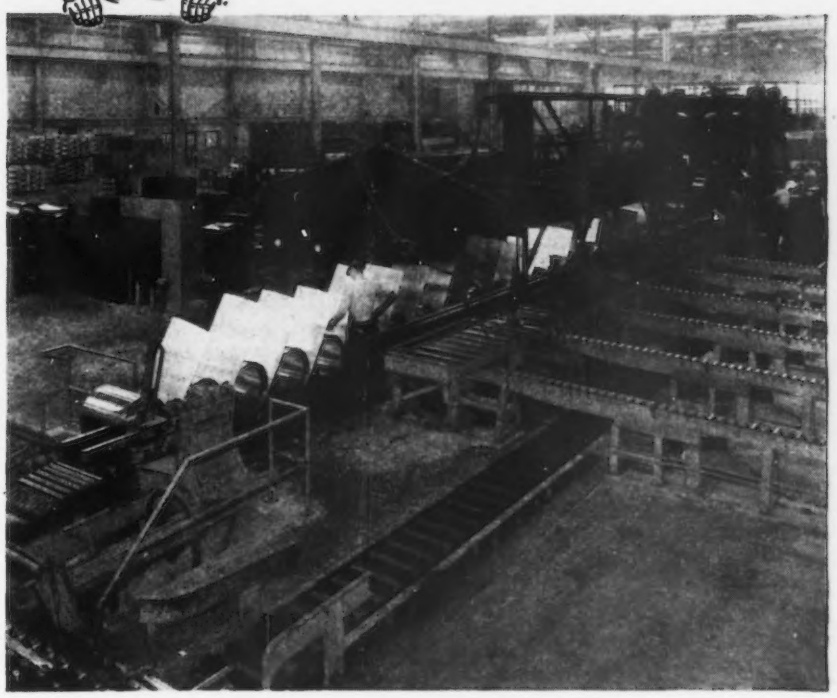
• • • Production at the Westinghouse Electric Corp. for the third quarter of 1946, exceeded any peacetime rate prior to late 1941, it was announced. Net sales billed in this period amounted to $100,716,520, on which the company reported an operating loss of $12,160,204. After giving effect to tax carry-back and adjustments from reserves, the net income for the quarter was $2,854,553.

Disregarding the first 6 months' operations this year, which were adversely affected by a strike of electrical workers, current postwar production is at a rate that would have been exceptional in any prewar year, reported Gwilym A. Price, president. Nevertheless, for the first time in its history Westinghouse finds it difficult to earn a profit at high production.

At the same time the demand exists to support expanded capacity production at Westinghouse for at least a year beyond that for an indefinite period, Mr. Price stated at a meeting of the company's board of directors. The backlog of unfilled orders at the end of September reached a record peacetime mark of $502,761,288. New orders amounting to $58,241,460 were booked in September alone.

HANDLING PROBLEMS DESERVE

Special ATTENTION



EVERY manufacturer, in striving to keep costs at a minimum, must deal with more or less difficult material handling problems. These are not always quickly solved, and usually require considerable thought by plant and conveyer engineers. Most experienced plant engineers agree that the use of Mathews methods and Mathews equipment means efficient material handling. That is why Mathews Engineers are usually called in on the problem requiring special attention. There are many types of Mathews Conveyers of both gravity and power designs, and from these types are selected the units which make up Mathews continuous flow conveyer systems. It is with such systems that prominent manufacturers are reducing worker fatigue and keeping materials moving through processing machinery, storage and shipping, with a minimum of product re-handling, costly confusion and delay.

It might be that a Mathews Engineer can show you what others in your industry have done to improve their material handling. We will welcome your inquiry and give it prompt and thorough service.

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ELLWOOD CITY, PENNSYLVANIA
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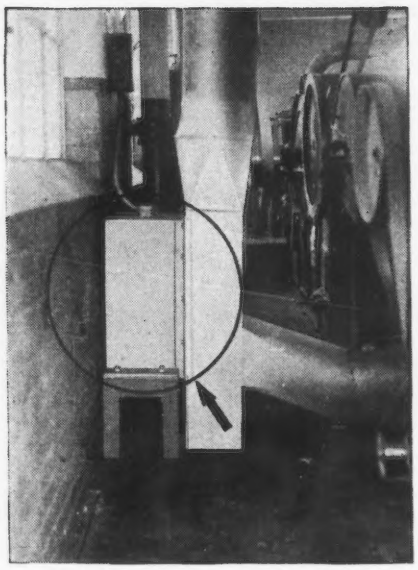

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You want a magnet designed and built by experienced magnetic engineers. If you have the problem of tramp iron in wind blown material, consult your Stearns Magnetic sales representative or write Stearns Magnetic, Milwaukee 4.

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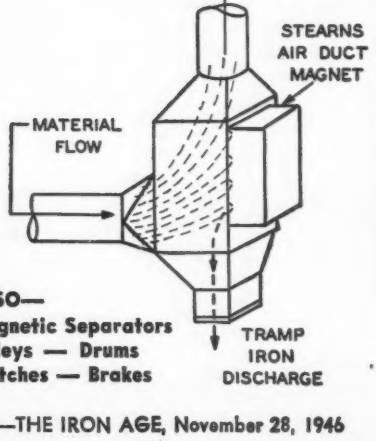

ALSO—
Magnetic Separators
Pulleys — Drums
Clutches — Brakes

Canada Acts to Reimburse Metal Producers for Exports at World Prices

Ottawa

• • • Canada has taken action toward extending control over all nonferrous metals produced in the Dominion. Wartime Prices and Trade Board, in a new order 665, names some 42 Canadian consumers of copper, lead and zinc, which must now make formal contracts with Canadian primary metal producers covering export of these metals in secondary, scrap or manufactured form. Monthly returns covering such exports now are required and the firms listed will pay a premium on all nonferrous metals used in articles of export. The premium will represent the difference between Canadian ceiling prices and the world prices for base metals. Following are comparative Canadian ceiling prices in cents per pound and United States prices:

	Canada	U.S.
Electrolytic copper	11.5	17.5
Electrolytic zinc	5.75	11.5
Lead	5.0	10.5

Included in the list of Canadian users of nonferrous metals which now must make contracts with domestic primary metal producers are the following:

Anaconda American Brass Ltd., New Toronto.
B.C. Metals, Vancouver.
Barber Die Casting Co., Toronto.
Beatty Bros., Ltd., Fergus.
Boston Insulated Wire & Cable Co., Hamilton.
Burgess Batter Co., Niagara Falls.
Cables, Conduits & Fittings, Ltd., St. Johns, Que.
Canada Metal Co., Ltd., Toronto.
Canada Wire & Cable Co., Ltd., Leaside, Toronto.
Canadian Bronze Powder Works, Ltd., Montreal.
Canadian General Electric Co., Toronto.
Canadian Locomotive Co., Kingston.
Canadian National Carbon Co., Ltd., Toronto.
Canadian Triangle Wire & Cable Co., Ltd., Toronto.
Canadian Tube & Steel Products, Ltd., Hamilton.
Carter White Lead Co. of Canada, Ltd., Montreal.
Dominion Steel & Coal Corp., Sydney, N.S.
Dominion Foils (Canada).
Exide Batteries of Canada, Ltd., Toronto.
Federal Wire & Cable Co., Ltd., Guelph.
Frost Steel & Wire Co., Ltd., Hamilton.
General Dry Batteries of Canada, Ltd., Toronto.
Globelite Batteries, Ltd., Winnipeg.
Gould Storage Battery Co., Toronto.
B. Greening Wire Co., Ltd., Hamilton.
Hart Battery Co., Ltd., St. Johns, Que.
Industrial Electric Products, Ltd., Toronto.
A. C. Leslie & Co., Toronto.
McArthur, Irwin, Ltd., Outremont, Que.
Metal & Alloys, Ltd., Leaside, Toronto.
Montreal Locomotive Works, Montreal.
Mount Royal Metal Co., Montreal.
Northern Electric Co., Montreal.
Page-Hersey Tubes, Ltd., Toronto.
Phillips Electric Works, Ltd., Brockville.
Prest-O-Lite Battery Co., Ltd., Toronto.
Schultz Die Casting Co. of Canada, Ltd., Wallaceburg.
Steel Co. of Canada, Ltd., Hamilton.
Tri-Sure Products, Ltd., St. Catharines.
Willard Storage Battery Co. of Canada, Ltd., Toronto.
Zinc Oxide Co. of Canada, Ltd., Montreal.

In addition all other firms that use nonferrous metals and subsequently export them in any form, must pay to the Export Permit Branch, Department of Trade and Commerce, the difference between Canadian ceiling price and world price on any metal used. The new set-up to take care of this latter group of consumers will operate through the Commodity Prices Stabilization Corp. The latter corporation is authorized to subsidize Canada's seven primary producers for metals bought by other than the 42 named firms and subsequently exported. In turn, the Export Credits Branch will recover the amount of the subsidy at the time the companies make application for export.

Primary producers named in the order are: International Nickel Co. of Canada Ltd., Noranda Mines Ltd., Hudson Bay Mining & Smelting Co., Ltd., Waite Amulet Mines Ltd., Sherritt Gordon Mines Ltd., Normetal Mining Corp., Ltd., and Consolidated Mining & Smelting Co. of Canada Ltd.

This new order is of considerable importance to Canada's primary base metal producers and will enable the mines to obtain full advantage of the higher prices for metals in the world markets and at the same time deprive speculators of the big profits they might gain in buying at domestic prices and selling in the export markets.

Previously a number of the named companies had informal arrangements with primary producers which enabled the producers to recover the premium on metals which were exported in secondary and manufactured form. All Canadian primary nonferrous metal producers are under strict government control as to distribution of their products between domestic and export markets. Thus if a consumer used metals purchased at the Canadian ceiling in goods manufactured for export, then the primary producer was the loser to this extent.

The actual goods covered in the

new order, for companies other than those listed are as follows:

(1) Primary nonferrous metals.

(2) Secondary nonferrous metals (scrap).

(3) Alloys and mill products.

(4) The following articles when more than 25 lb of any one nonferrous metal is used: wire cloth screen; locks and parts, where the major component is brass, bronze or zinc; valves and parts, where the major component is brass or bronze; stoves, lamps and parts; die castings and all die cast products; water, gas and electric meters; electric motors and generating equipment; electric transformers; bare and insulated electric wire and cable; key blanks; metallic foil; bolts, nuts, nails, grommets, rivets, and burrs of copper and brass; castings and bushings, finished or unfinished, of copper brass or bronze.

Jessop Completes Test On Clad Metal Bumpers And Other Accessories

Pittsburgh

• • • **Stainless clad** steel can now be used in the manufacture of automobile bumpers and other accessories heretofore made of chromium-plated steel or die castings, according to Fred T. H. Youngman, president of Jessop Steel Co., Washington, Pa. Development work that Jessop has been carrying on in the application of stainless clad steels to the automotive industry, started some months ago. has been completed.

The cladding for bumper stock runs about 0.001 to 0.0012 in. thick, and the base metal is clad on one side only. The reverse or back side of the bumper can be given a chromum flash plating or lacquered. Jessop anticipates an ultimate market for bumper stock of about 120 tons a day, and Jessop will buy the carbon stock upon which the stainless is clad. This stock will be one of the high tensile, low alloy steels such as Corten, Dynalloy, NAX, or a similar grade.

One automobile manufacturer estimates that the stainless clad bumper will cost between $5 and $10 more per car, but Jessop points out that at anticipated capacities the cost of the clad metal should be lower and the estimate is believed to be higher than necessary.

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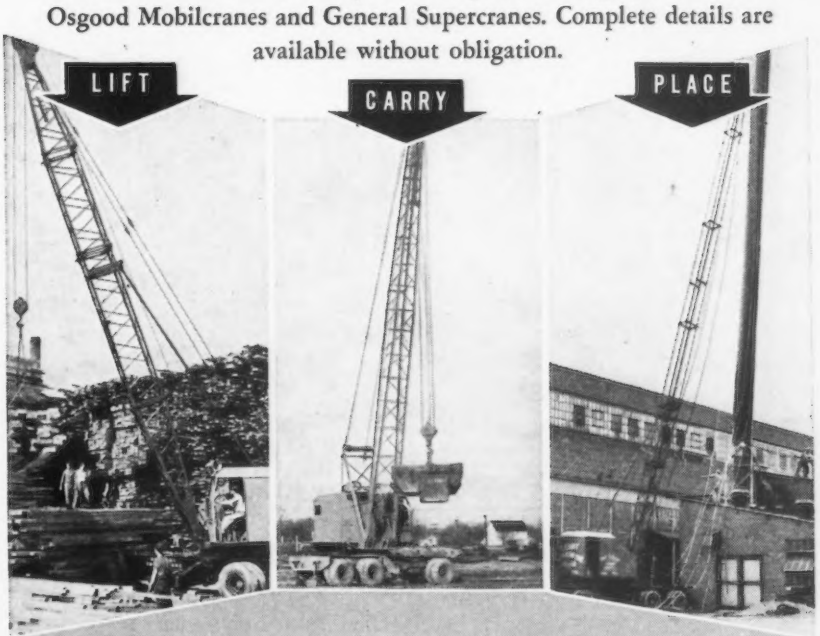
These are the things your handling system should have for efficient production. Lifting loads, carrying them *anywhere* in the plant or yards, placing them exactly where you want them—that's what Mobilcranes and Supercranes can do for you—and they do it economically too . . . thanks to one man operation, one engine power and pneumatic tires.

If you're looking for improved production efficiency, you'll be interested in the time, money and manpower savings possible with Osgood Mobilcranes and General Supercranes. Complete details are available without obligation.



OSGOOD MOBILCRANES • GENERAL SUPERCRANES

ONE-MAN OPERATED ONE-ENGINE POWERED

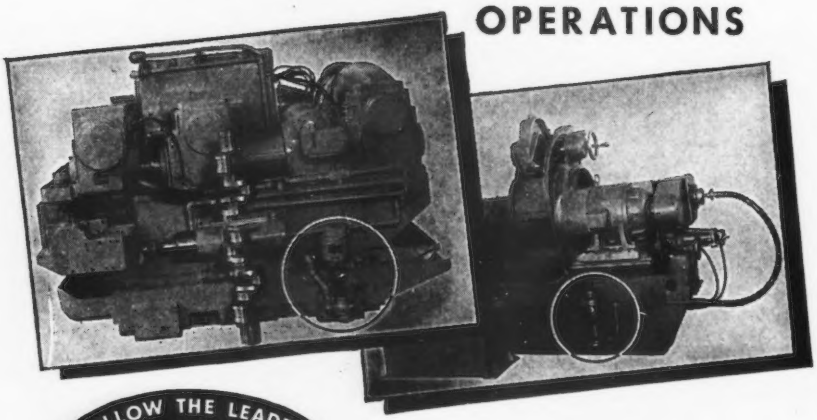
MOUNTED ON RUBBER TIRES

ONE-MAN CONTROLLED • ONE-ENGINE OPERATED • RUBBER-TIRED

THE OSGOOD CO. MOBILCRANES — THE GENERAL EXCAVATOR CO. SUPERCRANES

MARION, OHIO

SPEED CUTTING OPERATIONS



FOLLOW THE LEADERS USE "GUSHER" COOLANT PUMPS

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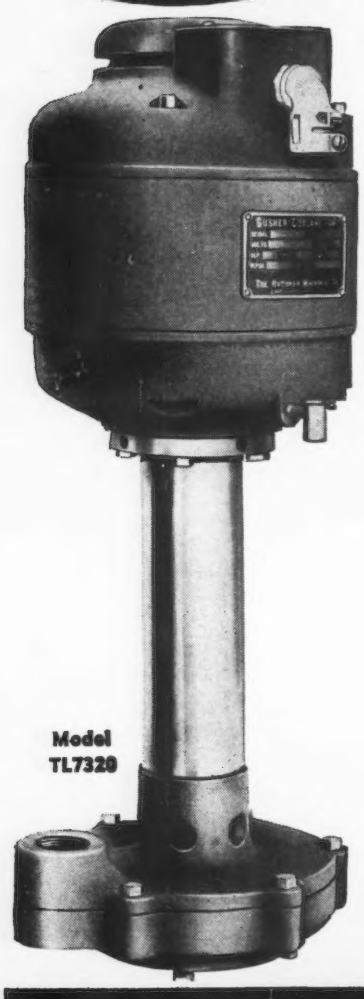


Model TL7320

To speed production on metal cutting operations, these leading manufacturers of machine tools turn to Ruthman Gusher Coolant Pumps.

Illustrated above left is a "MELLING" TYPE CRANKSHAFT CONTOUR TURNING LATHE, made by the Crankshaft Machine Company. It is equipped with a 1/4 H.P. MODEL SLO-7230 RUTHMAN GUSHER COOLANT PUMP. At the right is a SPECIAL "GARDNER" DOUBLE SPINDLE GRINDER with a 1/4 H.P. MODEL 11022 SHORT GUSHER COOLANT PUMP.

Satisfied customers are your best guarantee of the service a "GUSHER" will give you. Always specify them on your machines.

Write for Catalog 10B

*Photos courtesy The Crankshaft Machine Co. The Gardner Machine Co.

THE RUTHMAN MACHINERY CO.
1821 READING ROAD CINCINNATI 2, OHIO
THE "GUSHER"
A MODERN PUMP FOR MODERN MACHINE TOOLS

Engineers Council To Accredit Curricula Of Technical Institutes

New York

• • • **The Engineering Foundation announced through Dr. A. B. Kinzel, chairman of its board, the accrediting for the first time of engineering curricula of technical institutes by the Engineers' Council for Professional Development. Curricula at three institutes were approved: Wentworth Institute, Boston; Bliss Electrical School, Washington, D. C.; and Capitol Engineering Institute, Washington, D. C.**

The council, a project of the Engineering Foundation, was organized to enhance the professional status of the engineer. The council is a joint activity of the American Society of Civil Engineers, the American Institute of Mining & Metallurgical Engineers, The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Engineering Institute of Canada, the American Society for Engineering Education, American Institute of Chemical Engineers and the National Council of State Boards of Engineering Examiners. Through its function of accrediting engineering curricula, the council aims to insure a sound educational foundation for the practice of engineering.

Dean H. P. Hammond of Pennsylvania State College heads the committee accrediting technical institutes. Members of his committee are representatives of various types of institutions offering terminal technical programs, such as junior colleges, evening and extension divisions of colleges and universities, correspondence schools complying with certain regulations, and training programs of industry which fall within the technical institute field. Technical institutes are defined as being intermediate, that is, between high school or vocational school, and the engineering college.

The following curricula in the three schools were accredited: Architectural construction, electrical construction, machine construction and tool design, and steam and diesel engineering at Wentworth Institute; fundamentals of industrial electrical engineering at Bliss

Electrical School; and practical radio engineering, both resident and correspondence course, at Capitol Engineering Institute.

The program of accrediting technical institutes had its origin in an investigation made by the Society for the Promotion of Engineering Education (now the American Society for Engineering Education), 1924 through 1929. This and subsequent studies have shown that while the number of persons holding engineering degrees from colleges and universities is from four to six times the number of graduates of technical institutes, the demand for technical institute graduates by industry is from four to six times the supply.

The program is carried out by a subcommittee of the committee on engineering schools which accredits undergraduate engineering schools. At the present time, out of 167 degree-granting institutions in the United States, 133 now have one or more curricula accredited by the Council, with a total of 580 curricula accredited in major and specialized fields.

Air Conditioned Cars Predicted at Meeting

Detroit

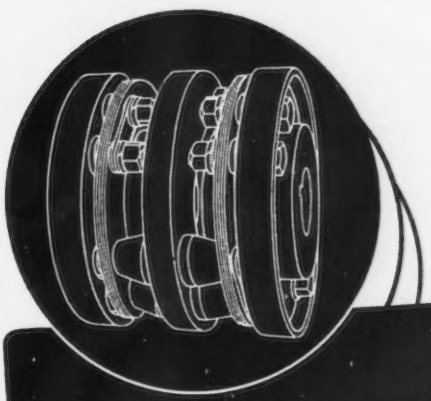
• • • **A prediction that** automobiles in the future will bring motorists the same winter and summer driving comfort as that we'll find in air conditioned homes was made by T. C. Gleason, Head of the Fluid Dynamics Laboratory, engineering division of Chrysler Corp., at a meeting of the Detroit Section SAE.

Mr. Gleason said that the efforts of the automobile industry to provide greater comfort and luxury is resulting in remarkable advance of the application of air conditioning principles to automobiles. A new set of standards has been established for the automobile, Mr. Gleason explained.

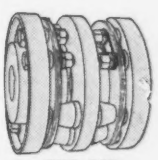
"In cold weather," he said, "it is of the utmost importance that windshields and windows be kept clear of fog or frost. Allowance must also be made for the fact that in winter, in addition to overcoats and gloves, the occupants of a car may frequently be wearing wet or snow-covered rubbers."

Heating systems with effectiveness comparable to the best residential practice should be common to the automobile in the next few years, Mr. Gleason said.

THOMAS
Flexible COUPLINGS
are specified by engineers wherever
100% dependability is demanded



THOMAS
Flexible COUPLINGS
provide for
Angular and Parallel Misalignment as well as Free End Float . . .
and Eliminate
BACKLASH, FRICTION, WEAR and CROSS-PULL
NO LUBRICATION IS REQUIRED!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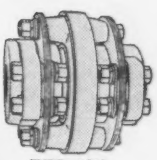
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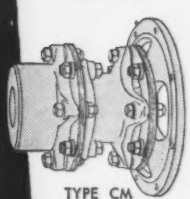
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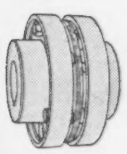
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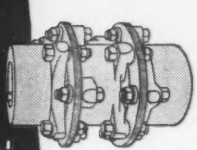
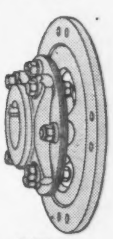

TYPE AM

The Thomas All-Metal Coupling does not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.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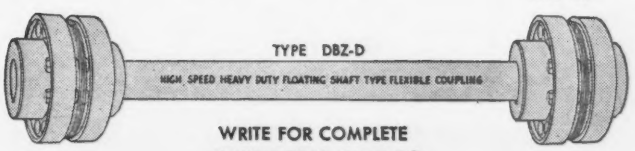
TYPE DBZ-D
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